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Message

Gujarat University has matured to become one of the prestigious institutions of higher education in India, since its establishment in late 1949. Students are the backbone of any educational institute. Therefore, conferring excellent education to our students in an encouraging environment will be our prime objective. we are also very much provocative to spend equal attention to the all-round improvement of our students and to afford them adequate opportunities for providing utterance to their creative and artistic talents, scientific excellence as well as sports manship.

Our next focus is on maintaining a world - class, comprehensive program of research and research training to make more research- minded scholars. We intend for international standards of perfection across the varieties of research, from basic, curiosity-driven work that raises the stock of knowledge and guides to translate new research proposal and innovation with direct applications to industry and communities. In order to meet these challenges, we plan to build the alliances and collaborative partnership with government, and other research institutions, cooperation and efficiency. There will be periodical improvements of internal regulations, policies and methods which benefit the university community.

The rapid evolution of this planet in all aspects encourages the academicians to provide the correct thrust for making life-long learners out of the students. In addition to this, our motto will be to c reate responsible human beings with the highest ethical and social conduct. In this context, I am impelled to use a quote of Sir Albert Einstein :

'It is the supreme art of the teacher to awaken joy in creative expression and knowledge.'

At length, I look forward to working with all the students, faculty members, administrative staffs and our partners and walk with our well-wishers in the challenging journey towards our goal to show the excellence of Gujarat University.

Prof. (Dr.) H. A. Pandya
Vice-Chancellor (I/C)

From The Editors Desk

It is with great pride, enthusiasm and anticipation that invite you to read the new issue of Vidya /2017 Vol.1.

It's a cliche but a useful one - We are a work of progress actively seeking ideas from campus & community in terms of structure, goals & vision. We remain open to where we are going and how we will get there. We hope that Vidya will be as dynamic as work going on in all our disciplines at the Gujarat University.We wish it would be a vehicle for academic review, promotion and reward. We want to make Vidya a difference not just on campus or in classrooms but in communities and society.

Be assured, Vidya is already a academic journal, uses blind peer review with rigorous evaluation criteria fully vetted through a editorial board- by Honorable Vice Chancellor nominated, our editorial board represents individual & collective knowledge talent, judgement & disciplinary backgrounds. Without their guidance it would be impossible to offer selection found in new issue.

I look forward to our journal to get better as we develop VIDYA to its fullest potential.

Prof. (Dr.) Meenu Saraf

Explaining the meaning of 'Association'.
Swami Vivekananda said: "The rain drop from the sky:
If it is caught in hands, it is pure enough for drinking.
If it falls in a gutter, its value drops so much that it can't be used even for washing the feet.
If it falls on hot surface, it perishes.
If it falls on lotus leaf, it shines like a pearl and finally,
If it falls on oyster, it becomes a pearl.
The drop is same, but its existence & worth depend on with whom it associates."

- Swami Vivekananda

Original Paper

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ગુજરાત યુનિવર્સિટી (૧૯૪૯-૨૦૧૬): પરિચય

ડો. અરુણ વાઘેલા*

પ્રોફેસર અને અધ્યક્ષ, ઇતિહાસ વિભાગ, ગુજરાત યુનિવર્સિટી, અમદાવાદ-૦૯

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ગુજરાત યુનિવર્સિટીની સ્થાપના (૧૯૪૯)સમયે ગુજરાતનું શૈક્ષણિક વાતાવરણ:

આજે ગુજરાતની સૌથી મોટી યુનિવર્સિટી ગણાતી ગુજરાત યુનિવર્સિટીની સ્થાપના ૨૩ નવેમ્બર ૧૯૪૯ ના રોજ થઈ હતી.સમયના વહેણ સાથે આજે ૨૦૧૬ ના વર્ષે,૬૭ વર્ષ પછી પશ્ચિમ ભારતની અગ્રગણ્ય યુનિવર્સિટી તરીકે વિકસી છે.

ગુજરાત યુનિવર્સિટીની સ્થાપનાની ઘટનાને એકલદોકલ યુનિવર્સિટીના સંદર્ભમાં જોવાને બદલે તત્કાલીન પશ્ચિમ ભારત અને ભારતના ઉચ્ચ શિક્ષણના વાતાવરણના સંદર્ભમાં જોઈએ તો તેનું મહત્વ સ્પષ્ટ થશે. ભારતમાં વૈદિક કાળથી શિક્ષણ-વિદ્યાકીય પ્રવૃતિઓના પ્રમાણો પ્રાપ્ત થાય છે, પરંતુ આજના શિક્ષણ જગતનું વ્યવસ્થિત માળખું બ્રિટિશ શાસનમાં શરુ થયું હતું. એક તરફ ભારતીયો બ્રિટિશરાજ સામે ૧૮૫૭નો સંગ્રામ ખેલી રહ્યા તો બીજી તરફ મુંબઈ, મદ્રાસ અને કલકતા જેવા મહાનગરોમાં એ જ વર્ષે ત્રણ યુનિવર્સિટીઓ સ્થપાઈ હતી. આમ તો ભારતના ઉચ્ચ શિક્ષણનો ઇતિહાસ ૧૮૧૭માં કલકતામાં સ્થપાયેલી હિન્દુ કોલેજથી શરુ થાય છે.

બ્રિટિશ અમલ દરમિયાન ગુજરાત મુંબઈ પ્રાંતનો ભાગ હતું, પરંતુ ૧૮૬૧ સુધી ગુજરાતમાં એક પણ કોલેજ ન હતી. જે મ્હેણું ૧૮૬૧ માં ગુજરાત કોલેજની સ્થાપના થતા ભાંગ્યું હતું. ગુજરાત કોલેજની સ્થાપના માટે અમદાવાદના નાગરિકોએ ૭૨,૫૦૦ રૂપિયા જેટલો ફાળો એકઠો કર્યો હતો જ્યાં 'લો લેકચર્સ'ના નામે વિવિધ વિષયો શીખવવમાં

આવતા હતા. પરંતુ ૧૮૭૨માં ૯ વર્ષ ચાલ્યા બાદ વિદ્યાર્થીઓની અપુરતી સંખ્યા અને મુંબઈ યુનિવર્સિટીનું જોડાણ નહીં મળવાથી કોલેજ બંધ કરવી પડી હતી. ૧૮૭૯માં 'ગુજરાત પ્રોવિન્શિયલ કોલેજ' તરીકે તે ફરીથી કાર્યરત થઈ હતી. ૧૯માં સૈકાનાં ઉતરાર્ધ સુધીમાં તો ૧૮૮૨માં વડોદરા, ૧૮૮૬માં ભાવનગરમાં શામળદાસ અને ૧૮૯૬માં જૂનાગઢમાં બહાઉદ્દીન જેવી કોલેજો શરુ થઈ ચુકી હતી. દેશ આઝાદ થયો ત્યાં સુધીમાં તો ગુજરાતની ૧૩ જેટલી કોલેજો યુવાનોની ઉચ્ચ શિક્ષણની ભૂખ સંતોષતી હતી. આ કોલેજો રાજકોટ (ધર્મેન્દ્ર કોલેજ, ૧૯૩૯), અમદાવાદ આર્ટ્સ કોલેજ (અમદાવાદ, ૧૯૩૪), નવસારી (૧૯૪૫) ઉપરાંત વિસનગર, નડિયાદ, વલ્લભવિદ્યાનગર (આણંદ) વગેરે જગ્યાએ હતી. આટલી કોલેજો હોવા છતાં તેની છત્રછાયા સમાન યુનિવર્સિટીની ગુજરાતમાં કમી હતી. જે ૧૯૪૯માં ગુજરાત યુનિવર્સિટીની સ્થાપના થતા પુરી થઈ હતી. તે જ વર્ષે વડોદરામાં એમ.એસ. યુનિ. શરુ થઈ હતી, પરંતુ તેનું કાર્યક્ષેત્ર વડોદરા શહેર પૂરતું જ સીમિત હતું.

ગુજરાત યુનિવર્સિટીના સ્વપ્નદ્રષ્ટાઓ :

ગુજરાત યુનિવર્સિટીની સ્થાપનાનો વિચાર અને અમલની દિશામાં અનેક વિદ્યાપુરુષોનો બૌદ્ધિક શ્રમ રહેલો હતો. આ યાદીમાં સૌ પ્રથમ નામ ગુજરાત વર્નાક્યુલર સોસાયટી(૧૯૪૮)ના સેક્રેટરી, શ્રી હીરાલાલ પારેખનું છે. તેમને 'બુધ્ધીપ્રકાશ' સામાયિકમાં ૧૯૧૭ના વર્ષે 'ગુજરાતી ભાષાના વધુ અભ્યાસ, વિકાસ અને વૃદ્ધિ અર્થે યુનિવર્સિટીની યોજના' શીર્ષકથી ચર્ચા શરુ કરી હતી. તેમને પ્રજાએ સ્વતંત્ર ગુજરાતી યુનિવર્સિટી સ્થાપવાનું કામ ઉપાડી લેવું જોઈએ એવી દલીલ રજુ કરી હતી. શ્રી પારેખે યુનિવર્સિટીની સ્થાપનાની યોજનામાં સાત અંગો હોવા જોઈએ તેની પણ ચર્ચા આ લેખમાં કરી હતી.

આજે ગુજરાત યુનિવર્સિટીના સેનેટ હોલના પ્રવેશદ્વાર પાસે જ જેમનું સ્ટેચ્યુ મુકાયેલું છે તેવા આનંદશંકર બાપુભાઈ ધ્રુવે પણ ગુજરાત યુનિવર્સિટીની સ્થાપનામાં બૌદ્ધિક પુરુષાર્થ કર્યો હતો. તેમને 'શિક્ષણ અને સાહિત્ય' નામના સામાયિકમાં ગુજરાત યુનિવર્સિટીની સ્થાપનાની તાત્વિક ભૂમિકા ચર્ચી હતી. તેમણે લખ્યું છે કે "ગુજરાતી ભાષા અને સાહિત્યને વિકસાવવા માટે એને યુનિવર્સિટીના અભ્યાસક્રમમાં મૂકી પરીક્ષાની ઘાણીમાં પીલવાની જરૂર નથી - સુંદર પુષ્પની વાડીની માફક એનો વિકાસ કરવો જોઈએ અને એ માટે કોલેજના વિદ્યાર્થીઓના ક્લબો, મંડળો સ્થાપવા જોઈએ." તેમણે એક ખાસ વાત એ કહી હતી કે 'ઘણી વિશિષ્ટતા તો મનુષ્યના ચહેરાની માફક, જન્મથી જ હોતી નથી પણ ધીમે ધીમે વિકસે છે. યુનિવર્સિટી જેમ જેમ વિકસશે તેમ તેમ એનું સ્વરૂપ અધિક વિશિષ્ટતા ગ્રહણ કરતુ જશે." યુનિવર્સિટીના આ સ્વપ્નદ્રષ્ટાની ભવિષ્યવાણીને આજે ૨૦૧૬માં ગુજરાત યુનિવર્સિટીએ પુરવાર કરી છે.

ભારતની લોકસભાના પ્રથમ સ્પીકર ગણેશ વાસુદેવ માવલંકર પણ ગુજરાત યુનિવર્સિટી વિદ્યાર્થીઓના સ્વપ્નદ્રષ્ટાઓ પૈકીના એક હતા. "ગુજરાત યુનિવર્સિટીની મારી કલ્પનાને હું મારુ સ્વપ્ન કહેતો નથી પણ એ મારી જાગ્રત અવસ્થા છે." જેવા તેમના શબ્દો તેમના યુનિવર્સિટી સ્થાપના પાછળના સમર્પણભાવની પ્રતીતિ કરાવે છે. આ જ ગાળામાં ડિસેમ્બર ૧૯૪૩માં વડોદરામાં શ્રીમતી વિદ્યાગૌરી નીલકંઠના પ્રમુખપદે ભરાયેલી સાહિત્ય પરિષદ યોજાઈ હતી. તેમાં ઉપસ્થિત સાહિત્યકારોએ ગુજરાત યુનિવર્સિટીની સ્થાપના માટેનો ઠરાવ રજુ કરી ગુજરાતના બૌધિકોની જવાબદારી નિભાવી હતી. આ જ પરિપાટી પાર અમદાવાદના નગરશેઠ કુટુંબના શ્રી કસ્તુરભાઈ લાલભાઈએ પણ ગુજરાત યુનિવર્સિટીની સ્વપ્ન સેવ્યું હતું. તેમણે કહેલું કે કોલેજો તો યુનિવર્સિટીના અવયવ માત્ર છે. આપણો આરાધ્ય દેવતા તો ગુજરાત યુનિવર્સટી છે. ઠાલા વિચારો જ નહીં, ગુજરાત યુનિવર્સિટી સ્થપાઈ ત્યારે ઉઘરાવેલા ૪૪,૬૮,૨૦૦ રૂપિયામાંથી માત્ર કસ્તુરભાઈ કુટુંબનો ફાળો જ ૧૨ લાખ રૂપિયા હતો. ગુજરાત યુનિવર્સિટીના મકાનોના બાંધકામમાં પણ તેમનું કિંમતી માર્ગદર્શન મળ્યું હતું. આમ ગુજરાત યુનિવર્સિટીની સ્થાપના થઈ તે પૂર્વે શિક્ષણવિદોના માનસપટ પર અંકિત થઈ ચુકી હતી.

ગુજરાત યુનિવર્સિટીની સ્થાપના:

ગુજરાત યુનિવર્સિટી સ્થાપવાની બૌદ્ધિક કવાયતને નજરમાં રાખી મુંબઈ રાજ્યના મુખ્યપ્રધાન શ્રી બાળાસાહેબ ખેરે શ્રી જી. એમ. માવલંકરના નેતૃત્વમાં એક સમિતિની રચના કરી જે ગુજરાત વિશ્વવિદ્યાલય મંડળ કહેવાય. ગુજરાત વિશ્વવિદ્યાલય મંડળે ગુજરાત યુનિ.ની સ્થાપના માટે ૯૨ પાનાનું લાબું નિવેદન મુંબઈ સરકારને સોંપ્યું હતું.

આખરે 'The Gujarat University Act' દ્વારા તારીખ ૨૩ નવેમ્બર ૧૯૪૯ના રોજ ગુજરાત યુનિવર્સિટીની સ્થાપના થઈ. આ સમયે આખા ભારતમાં માત્ર ૨૮ યુનિ.ઓ અને ૬૯૫ કોલેજો હતી. લોખંડીપુરુષ સરદાર પટેલે યુનિવર્સિટીના કામચલાઉ કાર્યાલયનું ઉદ્ઘાટન કર્યું. આજે ૨૬૦ એકર જમીન અને અનેક બિલ્ડીંગો ધરાવતી ગુજરાત યુનિવર્સિટીની શરૂઆત એચ. એલ. કોલેજના જીમખાના અને એલ.ડી. એન્જી. કોલેજની ઇલેકટ્રીક વિભાગની લેબોરેટરીમાંથી થઈ હતી. આ બંને સ્થાનોએ યુનિવર્સિટીના કામચલાઉ કાર્યાલયો હતા. તત્પશ્ચાત મુંબઈ સરકારે વસ્ત્રાપુર ગામ પાસે સર્વે ન. ૨૩૮માં સદા ચાર એકરનો પ્લોટ યુનિવર્સિટીનું કાર્યાલય બાંધવા માટે મફત આપ્યો હતો. યુનિવર્સિટીનું કાર્યાલય અને ભવનોના બાંધકામ માટે ગુજરાતીઓના દાનનો અવિરત પ્રવાહ શરુ થયો. અંદાજે એક કરોડ રૂપિયા એકઠા કરવાનો લક્ષયાંક હતો. ૧૪ ઓગસ્ટ ૧૯૫૩ના રોજ યુનિવર્સિટીના મુખ્ય કાર્યાલયના મકાનનું બાંધકામ શરુ થયું. જે માર્ચ ૧૯૫૪માં પૂરું થયું. ૧૬૦ ફુટ ઊંચા ટાવરવાળા બિલ્ડિંગમાં બે ભાગ વહીવટ માટે અને ત્રીજો માળ ગ્રંથાલય માટે ફાળવાયો હતો. પૂર્ણ કાળના આ ટાવરવાળા બિલ્ડિંગનું ઉદ્ઘાટન ૩ માર્ચ ૧૯૫૪ના રોજ મુંબઈ રાજ્યના તત્કાલીન શિક્ષણમંત્રી શ્રી દિનકરરાવ એમ. દેસાઈએ કર્યું હતું. ટાવરવાળું બિલ્ડીંગ આજે તો માત્ર ગુજરાત યુનિવર્સટી જ નહીં આખાય અમદાવાદ શહેરની ઓળખ સમું બની રહ્યું છે.

ગુજરાત યુનિવર્સિટીની વિકાસયાત્રા(૧૯૪૯-૨૦૧૬)

યુનિવર્સિટીની સ્થાપના પછીનું કામ તેની ભૌતિક સુવિધાઓ અને શિક્ષણયાત્રાને આગળ ધપાવવાનું હતું. વસ્ત્રાપુર ગામની હદમાં આ માટે ૫૬૦ એકર જમીન સંપાદિત કરી તેમાંથી ૨૬૦ એકર જમીન ગુજરાત યુનિવર્સિટીને ફાળવવામાં આવી. આમ ગુજરાત યુનિવર્સિટીનો જન્મ એક 'તંદુરસ્ત બાળક' તરીકે થયો. શરૂઆતમાં સમાજવિદ્યાભવન, મનોવિજ્ઞાન-તત્વજ્ઞાન , ભાષા-સાહિત્યભવન અને વિજ્ઞાન ભવનની શરૂઆત થઈ. યુનિવર્સિટીના પહેલા કુલપતિ તરીકે તત્વજ્ઞાનના અધ્યાપક અને નિવૃત ન્યાયાધીશ શ્રી હરસિદ્ધભાઈ દીવેટિયાની નિમણુંક થઈ. તેમણે પોતાના આઠ વર્ષના કાર્યકાળ દરમિયાન યુનિવર્સિટીના વિકાસમાં ગજબની કુનેહ દાખવી હતી. તારીખ ૨૦/૧૦/૧૯૫૦ ને દશેરાના દિવસે તેમણે યુનિવર્સિટીના પહેલા મંગળ પ્રવચનમાં કહેલું તે આજે પણ આપણને પ્રેરણા આપે તેવું છે." દેશની ખરી મૂડી તો તેના માનવદાનમાં રહેલી છે અને આવું માનવદાન ઉભું કરવું એ યુનિવર્સિટીનું મુખ્ય ધ્યેય છે." સમયાંતરે ગુજરાત યુનિવર્સિટીને મગનભાઈ દેસાઈ, ઉમાશંકર જોશી, ડો. પી.સી. વૈદ્ય, ઈશ્વરભાઈ પટેલ, એન. વી. વસાણી, કે. એસ. શાસ્ત્રી, એ. યુ. પટેલ જેવા કાર્યદક્ષ કુલપતિઓ સાંપડ્યા હતા. સાંપ્રતમાં ટેકનોક્રેટ ડો. એમ. એન. પટેલ ગુજરાત યુનિવર્સિટીનું સુકાન સાંભળી રહ્યા છે.

યુનિવર્સિટીના કુલપતિઓ જેટલું જ યોગદાન બિનશૈક્ષણિક કર્મચારીઓ અને અધ્યાપકોએ ગુજરાત યુનિવર્સિટીના વિકાસમાં આપ્યું છે. આવું સૌ પ્રથમ નામ શ્રી કંચનલાલ પરીખનું લેવું પડે. ૧૯૫૫થી ૧૯૮૧ સુધી લગભગ ૨૬ વર્ષ સુધી યુનિવર્સિટીનું કુલસચિવ પેડ સંભાળનાર કંચનલાલને ગુજરાત યુનિવર્સિટીના 'દીવાન' કહીએ તો પણ અતિશયોક્તિ નથી. અધ્યાપક આલમમાં ડો. અશ્વિન ત્રિવેદી (રસાયણશાસ્ત્ર), ગણિતશાસ્ત્રી પી. સી. વૈદ્ય, તત્વજ્ઞાન ક્ષેત્રે ડો. યજ્ઞેશ્વર શાસ્ત્રી, ઇતિહાસકાર ડો. મકરંદ મહેતા, હિન્દીમાં ડો. અંબાશંકર નાગર, પદ્મશ્રી ભોળાભાઈ પટેલ અને કુમારપાળ દેસાઈ, જ્ઞાનપીઠ પુરસ્કાર વિજેતા ઉમાશંકર જોશી અને ડો. રઘુવીર ચૌધરી, સમાજશાસ્ત્રી ડો. તારાબેન પટેલના વ્યક્તિત્વ અને કૃતિત્વથી પણ ગુજરાત યુનિવર્સિટીની રાષ્ટ્રીય અને આંતરરાષ્ટ્રીય ઓળખ ઊભી થઈ છે. ગુજરાત યુનિ.ના આ અધ્યાપકોએ માત્ર સંખ્યાની દ્રષ્ટિએ જ નહીં સંશોધન કર્યો દ્વારા યુનિની પ્રતિષ્ઠા ઉભી કરી

હતી.

યુનિવર્સિટીનું સત્તામંડળ એ યુનિવર્સિટી દિમાગ છે. નીતિવિષયક નિર્ણયો દ્વારા ગુજરાત યુનિવર્સિટીની શિક્ષણયાત્રાને ૧૯૪૯થી ૨૦૧૬ સુધી વિકસાવવામાં અનેક શિક્ષણશાસ્ત્રીઓનું પ્રદાન છે. ડો. વિક્રમ સારાભાઈ, ડોલરરાય માંકડ, ઠાકોરભાઈ દેસાઈ, યશવંત શુક્લ, ઘનશ્યામભાઈ ઓઝા, ઇન્દ્રવદન નાણાવટી, ડો. કે. કે. શાસ્ત્રી, ઉમાશંકર જોશી, એમ. એન. દેસાઈ, હીરલા ભગવતી, સુધી નાણાવટી, નરહરિ અમીન, જગદીશ ભાવસાર અને મનીષ દોશી જેવા અનેક સેનેટ , સિન્ડિકેટ મેમ્બરોએ ગુજરાત યુનિવર્સિટીના સત્તા મંડળમાં પોતાની જવાબદારીઓ સુપેરે નિભાવી છે.

ગુજરાત યુનિવર્સિટી સમાજ ઉત્કર્ષના ક્ષેત્રે :

ગુજરાત યુનિવર્સિટી રૂપી સુંદર બાગના પુષ્પો એ અહીંના વિદ્યાર્થીઓ.અભ્યાસના વિષયો તો ખરા જ, ગુજરાત યુનિ.ના વિદ્યાર્થીઓએ કાલા-સાહિત્ય અને સમાજસેવાના ક્ષેત્રે, યુવક મહોત્સવો, એન. એસ. એસ.ના નેજા નીચે સમાજસેવામાં અસાધારણ કૌવત દાખવ્યું છે. ડો.પરીખ અમેરિકી પ્રમુખ શ્રી બારાક ઓબામાના અંગત સલાહકાર તરીકે કાર્યરત હતા. ડો. તેજસ પટેલને તબીબી વિજ્ઞાની સિદ્ધિઓને લઈ તાજેતરમાં પદ્મશ્રીનો ઈલ્કાબ પ્રાપ્ત થયો છે તો ગીત-સંગીતની દુનિયામાં હર્ષદ જનાર્દન રાવલ જેવા અનેક કલાકારોએ યુનિવર્સિટીની ખુશ્બૂને દુનિયામાં ફેલાવી રહ્યા છે. શ્રી નરેન્દ્ર મોદી પણ આ જ યુનિવર્સિટીના વિદ્યાર્થી હતા, જેઓ આજના પરિચયના કોઈ મોહતાજ નથી.

ગુજરાતની સમસ્યા કે ગુજરાત પરની આફતને ગુજરાત યુનિવર્સિટીએ પોતાની ગણી છે. મોરબી શહેરમાં મચ્છુ બંધ તૂટ્યા પછીની હોનારત હોય, ગુજરાત પાર પડેલા દુષ્કાળો હોય, અમદાવાદના ગુજરાતના કોમી રમખાણો હોય કે પછી ૨૦૦૧નો કચ્છનો ભૂકંપ હોય ગુજરાત યુનિ. એ વ'સેવા પરમો ધર્મ'નું સૂત્ર સાર્થક કર્યું છે. શ્રમિક વિદ્યાપીઠ એ પણ ભૂતકાળમાં સમાજ ઉત્કર્ષના ક્ષેત્રે માતબર પ્રદાન કર્યું હતું. રક્તદાન, સ્વચ્છતા અભિયાન, રણ ફોર યુનિટી, વૃક્ષારોપણનો વિશ્વવિક્રમ વગેરે પણ ગુજરાત યુનિ.ની સિદ્ધિના સોપાનો છે. ગુજરાત યુનિ.એ આ દ્વારા ડો. રાધાકૃષ્ણને કહેલા શબ્દો." વિશ્વ વિદ્યાલય વિશ્વતમતાનું પ્રતીક છે. યુનિ.ને માત્ર એક જ જતી છે અને તે માનવજાતિ. આ એવું સ્થળ છે કે જ્યાં ચામડીના કોઈપણ રંગની નીચે, ચહેરા પર દેખાઈ આવતી કોઈપણ જ્ઞાતિની નીચે, સમાજની કોઈપણ તારાહની નીચે સમાન પ્રકારની ઉત્કટ ઈચ્છાઓ, સમાન એવા નૈતિક મૂલ્યો જોઈ શકાય છે." તે સાર્થક કાર્ય છે. એ રીતે ગુજરાત યુનિ. લોકજીવનની સામાજિક સંસ્થા બની છે, દેશકાળને ઘડનારું પરિબળ પણ બની છે.

ગુજરાત યુનિવર્સિટી સાંપ્રત:

૧૯૪૯માં સ્થાપના સમયે ચાર અનુસ્નાતક ભવનો અને ૧૩ સંલગ્ન કોલેજો સાથે ગુજરાત યુનિ.ની શિક્ષણયાત્રા શરુ થઈ હતી જે એમ. એસ. યુનિવર્સિટી સિવાયની બધી જ યુનિવર્સિટીઓનો જન્મ ગુજરાત યુનિવર્સિટીમાંથી થયો છે. આ પહેલા આખા ગુજરાતની કોલેજ ગુજરાત યુનિવર્સિટી હસ્તક હતી. આજે તો ૪૭ અનુસ્નાતક ભાવનો, ૫૦ સંલગ્ન શૈક્ષણિક સંસ્થાઓ અને ૩૭૨ કોલેજો સુધી વિસ્તરી છે યુનિવર્સિટીનું ગ્રંથાલય અંદાજે સાડાત્રણ લાખ ગ્રંથો ઉપરાંત હસ્તપત્રો, સામાયિકો, એ-બૂક્સનો ખજાનો ધરાવે છે. યુનિવર્સિટીના વિજ્ઞાન, વાણિજ્ય અને વિનયન ભવનોએ અનેક રાષ્ટ્રીય અને આંતરરાષ્ટ્રીય પરિસંવાદો યોજી આગવું સંશોધન ઉભું કર્યું છે. ૧૯૭૪માં શરૂ થયેલું એ.ડી. આઈ.એ.એસ. ટ્રેનિંગ સેન્ટર એક સમયે ગુજરાતભરમાં પ્રસિદ્ધ થયું હતું. યુનિ.નું આરોગ્ય કેન્દ્ર ૧૯૬૩ માં શરૂ હતું, જે યુનિ. ના કર્મચારીઓ, અધ્યાપકો અને વિદ્યાર્થીઓને તંદુરસ્ત રાખવાની ફરજ બજાવે છે. પત્રકારત્વ ભવન, ઈ.એમ.આર.સી., ઈકવલ ઓપર્ચ્યુનિટી સેલ, ડો. આંબેડકર ચેર, એમ.એસ.ડબ્લ્યુ ઉપરાંત હ્યુમન જિનેટિક્સ અને મોબાઈલ એપ્લિકેશનના અભ્યાસક્રમો આજે ગુજરાત યુનિ.ની ઓળખ બન્યા છે. ૧૯૫૭ થી શરૂ થયેલું 'વિદ્યા' નામના યુનિ.નું મુખપત્ર એ સંશોધનોના પ્રકાશનના સંદર્ભમાં નવા કીર્તિમાનો સ્થાપ્યા હતા. 'વિદ્યાવૃત્ત' યુનિ.ની ગતિવિધિઓને ગુજરાતના શિક્ષણજગત અને સમાજ સુધી પહોંચાડે છે. તો યુનિ.ના પ્રકાશન વિભાગ એ સ્થાપનાકાળથી આજ સુધીમાં લગભગ એક હજાર કરતા વધું પુસ્તકો પ્રકાશિત કાર્ય છે. જેમાં વિનયન, વાણિજ્ય અને વિજ્ઞાનના વિષયોની પરિભાષા

કરતા પુસ્તકોની સંખ્યા ૩૦ કરતા વધુ છે. ખરેખર, આ બહુ જ મોટી સિદ્ધિ છે. ટૂંકમાં સંશોધન, ગ્રંથાલય અને પ્રકાશનના સંદર્ભમાં ગુજરાત યુનિ. અદ્યતન સ્થિતિ ધરાવે છે.

સમય પ્રવાહમાં ગુજરાત યુનિ. શૈક્ષણિક ઉપરાંત સામાજિક અને આર્થિક રીતે પણ વધુને વધુ પરિપક્વ થઈ છે. તાજેતરમાં જ યુનિ.ના પ્રવેશની કામગીરી ઓનલાઇન એડમિશન દ્વારા સંપન્ન કરી ગુજરાત યુનિ.એ કીર્તિમાન રચ્યો છે. પરીક્ષાઓના પરિણામો સમયસર જાહેર કરી વિદ્યાર્થીઓની ચાહના પ્રાપ્ત કરી છે. એક સમયે સેનેટ, સિન્ડિકેટની ચૂંટણીઓમાં ચાલતા ગંદા રાજકારણ, વેરભાવ અને રાગદ્વેષ આજે ભૂતકાળ બની ચુક્યા છે. જેનો શ્રેય ગુજરાત યુનિ.ના વિદ્યમાન કુલપતિશ્રી ડો. એમ. એન. પટેલ અને તેમની ટીમને ફાળે જાય છે. યુનિ. કન્વેનશન સેન્ટર ગુજરાતભરના વ્યવસાયિકો માટે આકર્ષણનું કેન્દ્ર બન્યું છે. ગુજરાતભરની સાંસ્કૃતિક પ્રવૃતિઓ માટે પણ યુનિવર્સિટી કન્વેનશન સેન્ટર પ્રથમ પસંદગી બની રહી છે. જે સાંપ્રત સમયમાં યુનિ.ની આવકનો પણ મોટો સ્ત્રોત છે વળી, ગુજરાત યુનિવર્સિટીના વહીવટીકર્તાઓની સુઝબુઝ અને દીર્ઘદ્રષ્ટિને પરિણામે ગુજરાત યુનિ. આર્થિક રીતે સંપૂર્ણપણે સક્ષમ બની છે.

આમ, ૧૯૪૯માં સ્થપાયેલી ગુજરાત યુનિ. અનેક તડકી-છાંયડીઓ જોઈ આજના મુકામ પાર પહોંચી છે. બદલાતા સમય અને સંજોગો પ્રમાણે ઘટતાં પરિવર્તનો કરી ગુજરાતની તો ખરી જ, સમગ્ર પશ્ચિમ ભારતની અગ્રણી યુનિ. બની રહી છે. યુનિ. ના પદવીદાન સમારંભોમાં શ્રી નરેન્દ્ર મોદી, સુનિતા વિલિયમ્સ ઉપરાંત સમયે સમયે યુનિ.ની મુલાકાતે આવેલા ડો. મનમોહનસિંઘ, શ્રી કપિલ સિબ્બલ, ડો. મુરલી મનોહર જોશી, શ્રી અરુણ જેટલી અને ગીત શેઠી રમતવીરો પણ યુનિ.ની પ્રવૃત્તિઓને બિરદાવી છે.

ગુજરાત યુનિ. જેવી વિશાળકાય અને અંદાજે સદા છ દાયકા જેટલો ભવ્ય ભૂતકાળ ધરાવતી યુનિ.ના ઇતિહાસને આવા નાના લેખમાં સમાવવો એ તો ગાગરમાં સાગર ભરવા સમાન છે. ખરેખર તો આ વિષય સ્વતંત્ર પુસ્તકલેખનનો છે. એ થશે ત્યારે ગુજરાત યુનિ.નો જ્ઞાન -વિચારોના સંરક્ષણ, વિતરણ અને વિવેચન, સત્યનું અન્વેષણ તથા બૌદ્ધિક-સાંસ્કૃતિક ધોરણો ક્ષેત્રે તેના ઇતિહાસની નોંધ થઈ ગણાશે.

સંદર્ભ સૂચિ

૧) ગુજરાત યુનિ.ના વાર્ષિક અહેવાલો,વર્ષ ૧૯૫૫-૫૬થી ૨૦૧૫ સુધી

૨) બુધ્ધીપ્રકાશ (માસિક) ૧૯૧૭

૩) શિક્ષણ અને સાહિત્ય (માસિક) ૧૯૧૭

૪) આનંદશંકર ધ્રુવ શ્રેણી, કેળવણી વિચાર (સપા. યશવંત શુક્લ અને અન્ય), ગાંધીનગર, ૨૦૦૨

૫) ધનવંતભાઈ દેસાઈ, શૈક્ષણિક પ્રશાશન, અમદાવાદ, ૧૯૭૬

૬) શ્રી હરસિદ્ધ દિવેટિયા લેખસંચય

૭) કંચનલાલ પરીખ, ગુજરાત યુનિવર્સિટીના ક્રાંતદર્શી કુલપતિ મગનભાઈ દેસાઈ, અમદાવાદ, ૧૯૯૯

૮) આર. કે. શાહ, (સંપા) પ્રોફે. અશ્વિનભાઈ ત્રિવેદીની જીવનકથા, અમદાવાદ, ૧૯૭૫

૯) રઘુવીર ચૌધરી, તિલક કરે રઘુવીર-૨, અમદાવાદ, ૧૯૯૮

૧૦) ઉમાશંકર જોશી, કેળવણીનો કીમિયો, અમદાવાદ, ૧૯૭૭

૧૧) હરિપ્રસાદ શાસ્ત્રી(સંપા)ગુજરાતનો રાજકીય અને સાંસ્કૃતિક ઇતિહાસ,અમદાવાદ,૧૯૮૯

૧૨) Moonis Raza,Higher Education in India:Retrospect and Prospect, Delhi, ૧૯૯૧

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Efficacy and Functional Aspects of Commercially Available Probiotic Products

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Abstract

Probiotics are the health promoting viable microorganisms that exhibit a beneficial effect on the health of human being by improving the intestinal microbial balance. Probiotic bacteria may produce various compounds, which are inhibitory to the growth of pathogen, which include organic acids (lactic and acetic acids), bacteriocins, and reuterin. In the present study, a total of six commercial probiotic products were assessed if they contain efficient probiotic microbes which could survive in the human GIT thereby promoting positive health benefits to humans. Total four isolates were isolated and tested for their probiotic potentials. Futher all four of them were also checked for their functional aspects *in vitro.* All isolates were found to be Gram positive and were evaluated to be efficient probiotics. They were identified by Vitek 2 compact method and found to be *Saccharomyces cerevisiae, Lactobacillus sporogenes, Enterrococcus hirae* and *Alicyclobacillus acidocaldarius.*

Introduction

The term probiotic was defined as "a live microbial feed supplement which beneficially affects the host animal by improving its microbial balance'' (Aslam and Qazi, 2010). Probiotic bacteria may produce various compounds, which are inhibitory to the pathogen's growth, which include organic acids (lactic and acetic acids), bacteriocins, and reuterin. The organic acids not only lower the pH, thereby affecting the growth of the pathogen, but they can also be toxic to

the microbes (Tambekar and Bhutada, 2010). There is increasing evidence that probiotics are beneficial in gastrointestinal disturbances, such as diarrhoea, dysentery, typhoid etc (Tambekar and Bhutada, 2010).

The most common genera *Lactobacillus* and *bifidobacterium,* because they are considered as GRAS (Generally Recognized As Safe) (Butel 2014). *Lactobacillus* and *Bifidobacterium* species are also dominant inhabitants in human intestine (Rivera Espinoza 2010). However bacterial species belonging to *Lactococcus, Enterococcus, Propionibacterium,* yeasts and filamentous fungi are also used as probiotics due to their health promoting nature (Tripathi and Giri 2014). However more specific and profound targeted function in the human alimentary tract is provided by dairy probiotic products supplemented with multispecies (Saxelin et al., 2010).

Lactic acid bacteria (LAB) are a group of Gram positive, non-spore forming, cocci or rods which produce lactic acid as major end product from fermentation of carbohydrates. Majority of microorganisms used as probiotics belong to the LAB and *Bifidobacteria*. Within the group of LAB, *Lactobacillus* species are most commonly utilized group of microorganisms for their potential beneficiary properties as probiotics. Lactic acid bacteria including *Lactobacillus, Leuconostoc, Lactococcus, Pediococcus* and *Bifidobacterium* are found throughout the gastrointestinal tract.

Lactobacillus and *Bifidobacterium spp.* are prominent members of the intestinal flora and are the commonly studied probiotic bacteria. They cause reduced lactose intolerance alleviation of some diarrhea's, lowered blood cholesterol, increased immune response and prevention of cancer. The selection criteria for probiotic LAB include: safety, viability/activity in delivery vehicles, resistance to acid and bile, adherence to gut epithelial tissue ability to colonize the gastro -intestinal tract, production of antimicrobial substances, ability to stimulate a host immune response and the ability to influence metabolic activities such as vitamin production, cholesterol assimilation and lactose activity (Savodago *et al*., 2006).

Lactic acid bacteria (LAB) play a critical role in food production and health maintenance. There is an increasing interest in these species to reveal the many possible health benefits associated with them. The actions of LAB are species and strain specific, and depend on the amount of bacteria available in the gastrointestinal tract. Consumers are very concerned of chemical preservatives and processed foods. However, products with or processed with LAB are accepted as a natural way to preserve food and promote health.

Probiotic products need to be supplemented with additional ingredients to support the viability throughout processing, storage, distribution, and gastrointestinal tract to reach the colon. Several reports have shown that survival and viability of probiotic bacteria is often low in yogurt. The efficiency of added probiotic bacteria depends on dose level and their viability must be maintained throughout storage, products shelf-life and they must survive the gut environment.

Therefore an attempt was made to isolate probiotic bacteria from commercial products and

to evaluate their potential as probiotics.

Materials And Methods

Isolation and identification of bacteria from commercial samples

For isolation of probiotic bacteria, serial dilution agar technique was used. Serial dilution of 10^{-1} to 10^{-7}were prepared. 0.1 ml of each dilution was inoculated to MRS agar plates and incubated at 37^0C for 24-48h for bacterial growth. The plates were observed for appearance of colonies and each of the isolates were purified onto the slants which were maintained in refrigerator for further analysis. Cultural and morphological characteristics were noted for all the isolates. Further confirmative tests like Gram staining, 3% KOH string test, acid fast staining, capsule staining, metachromatic granule staining, catalase test, oxidase test and motility test were performed.

Evaluation of probiotic potentials of isolated bacterial cultures

pH tolerance: The isolated bacterial cultures were inoculated into sterile MRS broth tubes of varying pH, i.e. pH 2, 3, 4, 5, 6, 7 and 8 and incubated at 37^0C for 2-3 days. Sensitivity to low pH conditions by the acid tolerant LAB were determined according to the method followed by (Anukam 2007).

Bile salt tolerance : The isolates were inoculated onto sterile MRS agar plates with varying bile concentrations (0.1, 0.2, 0.5, 1.0, 1.5, 2.0 and 2.5%) and incubated at 37^0C for 48h. The growth of cultures on agar plates was used to designate isolates as bile salt tolerant (Tambekar and Bhutada, 2010).

NaCl tolerance: The test isolates were grown in MRS broth tubes for 24h at 37ºC containing variable salt concentrations of 1%, 3%, 5%, 8%, 10% and 15% . Growth of the bacterial isolates was determined spectrophotometrically at 600 nm.

Temperature sensitivity: The selected bacterial cultures were grown at varying temperatures, i.e. 37, 55, 4^0C and room temperature for 48-72 hrs. (Tambekar and Bhutada, 2010).

Lactose utilization: Sterilized fermentation medium was inoculated with different cultures and incubated at 35ÚC for 24-48 hrs. Change in colour from red to yellow indicates the production of acid (Ahmed and Kanwal, 2004)

Antibiotic susceptibility: The test isolates were initially grown in the MRS broth at 37ºC for 24h under microaerophilic condition for activation. 0.1ml suspension of standardized freshly grown bacterial cultures was spread on MRS agar plates. The antibiotic discs were placed on the surface of agar and the plates were incubated at 37ºC for 48 hrs. Positive results were observed as zone of inhibition surrounding the disc.

Titrametric determination of lactic acid production: MRS broth was inoculated with activated test isolate cultures. Samples were withdrawn from each flask and centrifuged at 10,000rpm for 15 minutes. Collected supernatant was titrated with 2-3 drops of phenolphthalein

against 0.1 (N) NaOH. Amount of NaOH used for titration was noted and lactic acid % was calculated (Demirci 1994).

Functional aspects of probiotic isolates

Cholesterol lowering potential: The cholesterol estimation was done by CHOD-POD method. A 9.9 ml of MRS broth containing 0.2% bile salt (w/v) was mixed with 0.05 ml of serum containing high cholesterol was inoculated separately with 0.1ml of 24h active test culture isolates. Control containing 9.9 ml of MRS broth adjusted with 0.2% bile salt and 0.05 ml of serum was prepared containing high cholesterol but without inoculation of isolates. Further initial and final cholesterol estimation for each MRS broth containing serum of high cholesterol was estimated by enzymatic method using cholesterol estimation kit.

Calculation

Amount of cholesterol present in the serum was calculated by the following equation:-

Cholesterol (mg/dl) = absorbance of test/ Absorbance of standard x 200

Exopolysaccharide production: Active inoculums of isolates were inoculated in sterilized modified MRS broth. Initial and final viscosity of broth was measured after five days and finally the broth was proceeded for EPS extraction

Antimicrobial activity: The test organisms were enriched in nutrient broth. Antimicrobial activity was determined by agar well diffusion method. Sterile Mueller Hinton agar plates were then inoculated with 0.1 ml of each standardized test cultures by spread plate method. Wells of approx 6-7 mm were prepared and loaded with 0.02 ml of isolated probiotic culture supernatents and these plates were incubated at 37ºC for 24-48h. The antimicrobial activity was determined by measuring the diameter of inhibition zone (mm) surrounding the wells.

Haemolytic activity: 24 h activated cultures were spot inoculated onto the blood agar medium and the plates were observed as clear zones surrounding the colonies.

Cell surface hydrophobicity determination (to assess adhesion property of probiotics): Cell surface hydrophobicity of isolates was determined by microbial adhesion to hydrocarbons (MATH) method described by (Geertsema-Doornbusch *et al.,* 1993) using hexadecane and toluene as solvents.

Oxalate degradation capacity

The isolated cultures were tested for oxalate utilization using agar well-diffusion method in calcium oxalate plate as described by Allison and Campieri (Allison 1985 and Campieri et al., 2001).

Identification of the isolates

Genetic identification of all the four isolates was done by API card system i.e. by **VITEK 2 COMPACT** method. Vitek 2 is an automated microbiology system utilizing growth based technology. This system works on colorimetric reagent cards that are incubated and are interpretated automatically.

Results And Discussions

Probiotic potential of cultures : pH and Bile salt tolerance

In the present study, total four isolates were isolated from the assessed commercial probiotic products. These isolates were tested for their probiotic potentials like pH, salt, bile salt tolerances and different temperature conditions. In the present study, all the isolates showed least growth at pH 2, hence its concluded that isolates LBC and VBT were able to grow at 3pH leaving the rest isolates that show only 50% survival in the GIT. In case of bile tolerance isolates were able to survive at 0.1%, 0.2%, 0.5%, 1% and 1.5% bile salt concentrations. In addition the LBC isolate was able to survive even at 2% bile concentration. On other hand lactic acid bacteria isolated from baobab (maari) fermented seeds were able to survive at pH 2.5 but could tolerate bile salt concentration of 0.3% only (Kabore *et al.*, 2012). Tambekar (2010) reported that the three isolated excellent probiotic acid tolerance at pH 2.0 and bile salt tolerance at 2.0%. Tolerance to bile salts is a prerequisite for colonization and metabolic activity of bacteria in the small intestine of the host (Havenaar et al.,1992). This will help *Lactobacilli* to reach the small intestine and colon and contribute in balancing the intestinal microflora (Tambekar and Bhutada, 2010).

NaCl tolerance, Temperatures, and Lactose utilization

In case of varying salt concentrations, the isolates were able to survive at 1-8% with the isolate LBC as an exception surviving even at 10% concentration. If the lactic acid bacteria was sensitive to NaCl then it would not be able to show it's activity in presence of NaCl so it was essential to test the NaCl tolerance of lactic acid bacterial isolates, whereas Hoque *et al.* (2010) observed the NaCl (1-9%) tolerance of their *Lactobacillus* sp. isolated from yoghurts. Whereas isolates were tested for varying temperature conditions and were found to survive at temperature 37ºC, 55ºC and room temperature. The temperature is an important factor which can dramatically affect the bacterial growth. The reason for choosing this temperature range was to detect whether the isolated cultures were able to grow within range of normal body temperature or not. As if the isolates were not able to survive within the selected temperature range then they would not have been able to survive in the human gut, which is an essential factor of probiotics to show their effectiveness. The results obtained were positive for growth at chosen temperature range. The entire selected LAB isolates were grown in fermentation medium supplemented with lactose and were observed for change in colour from red to yellow which indicates the production of lactic acid. Lactose utilisation of LAB isolated from camel milk was assessed by Ahmed and Kanwal (2004).

Antibiotic susceptibility

Further isolates were tested against twelve antibiotics and susceptibility pattern was noted down for all of them. Isolate A was sensitive to drug Ampicillin (10mm), Co-trimoxazole (21mm), Cephalexin (25mm), Tetracyclin (7mm), Ciprofloxacin (18mm), Levofloxacin (12mm), Linezoloid (14mm), Cloxacillin (16mm), Roxythromycin (12mm), Lincomycin (9mm), Gentamicin (10mm).

Isolate B was sensitive to drug Ampicillin (22mm), Co-trimoxazole (20mm), Cephalexin (24mm), Tetracyclin (7mm), Ciprofloxacin (19mm), Levofloxacin (18mm), Linezoloid (15mm), Cloxacillin (18mm), Roxythromycin (10mm), Lincomycin (8mm), Gentamicin (7mm). Isolate C was sensitive to drug Ampicillin (23mm), Co-trimoxazole (17mm), Cephalexin (20mm), Tetracyclin (14mm), Ciprofloxacin (16mm), Levofloxacin (23mm), Linezoloid (22mm), Cloxacillin (15mm), Roxythromycin (12mm), Lincomycin (13mm), Gentamicin (9mm). Isolate D was sensitive to drug Ampicillin (25mm), Co-trimoxazole (15mm), Cephalexin (10mm), Tetracyclin (22mm), Ciprofloxacin (18mm), Levofloxacin (24mm), Linezoloid (20mm), Cloxacillin (17mm), Roxythromycin (14mm), Lincomycin (12mm), Gentamicin (10mm). In addition all the isolates showed resistance to the drug cefotaxime.

In present study isolates were sensitive for Cephalexin but contrary to present work, the work done by Tambekar and Bhutada (2010) the isolates were resistant to Cephalexin. This may vary from strain to strain or type of strain.

Functional applications

In vitro cholesterol lowering property

Further some of the functional applications were also performed *in vitro*. Initially cholesterol lowering effect was assessed for all the isolates. All the isolates were able to reduce high serum cholesterol. The initial cholesterol levels in the MRS broth for all the isolates were found to be 252, 280, 350 and 271mg/dl respectively. And the final cholesterol levels reduced by the isolates were found to be 134, 147, 125 and 143mg/dl respectively. Since deconjugated bile acids are less soluble and are less likely to be absorbed from the intestinal lumen than are conjugated bile salts, free bile is more likely to be excreted through the intestinal tract. Therefore, with the help of BSH, deconjugation of bile salts could lead to a reduction of serum cholesterol by reducing cholesterol absorption through the intestinal lumen. Klaver and vander Meer (1993) showed that the degree of deconjugation by *L. acidophilus* RP32 was higher under more acidic conditions than if the pH was maintained at 6.0. They concluded that the removal of cholesterol was due to its coprecipitation with deconjugated bile salts in an acidic environment.

EPS production

Next assessed parametre was the EPS production activity. From the observed results all the isolates were able to produce EPS in the MRS broth supplemented with additional 5% sucrose. The obtained EPS production for all the isolates was 1.087, 1.035, 1.071 and 1.064 g/100ml respectively. Kanmani et al., 2011 determined the production of EPS from *S. phocae* PI80 and *E. faecium* MC13 which was influenced by addition of carbon sources lactose (20 g L-1) and sucrose (30 g L-1) in MRS broth. Similarly, Ismail and Nampoothiri (2010) reported that maximum EPS production by *L. plantarum* MTCC 9510 was observed in presence of lactose (40 g L-1). Arskold et al. (2007) reported that the production of EPS from *L. reuteri* ATCC 55730 was significantly influenced by sucrose (100 g L-1). Wang et al. (2010) reported that the amount of EPS production and properties are greatly dependent on the microorganisms

and their culture conditions such as temperature, pH and media composition.

Cell surface hydrophobicity determination and Antimicrobial activity

Third parameter was the cell surface hydrophobicity determination. This parameter was carried out in order to determine microbial adhesion to hydrocarbons by (MATH) method. All the isolates exhibited adhesing capacity to hydrocarbons. Hence these isolates can also be further tested on animal models or *in vivo.*The adhesion percent for all the isolates were 61.30%, 66.82%, 49.16% and 50.06% respectively. Piette and Idziak (1992) have reported that cell-surface charge and hydrophobicity can considerably influence the strength of adhesion. Jacobson *et al*., (1999) suggested adhesion scores of all the isolates except *L. delbrueckii* subsp. *bulgaricus* CH4 were more than 100 and therefore, *L. plantarum* Lp9, Lp72, Lp75, Lp77, Lp90 and Lp91 can be regarded as strongly adhesive. The fourth parameter studied was the antimicrobial activity. Maximum zone of inhibition was shown by the isolate LBS against *S.aureus* of 24mm followed by *E.coli* (20mm), *B.cereus* (18mm) and *B.megaterium* (17mm) ; isolate VBT showed maximum zone of inhibition against *B.megaterium* of 22mm followed by *E.coli* (19mm), *S.aureus* (13mm) and *B.cereus* (11mm) ; isolate AFC showed maximum zone of inhibition against *E.coli* of 23mm followed by *B.megaterium* (20mm), *S.aureus* (16mm) and *B.cereus* (14mm) and lastly the isolate LBC showed the maximum zone of inhibition against *S.aureus* by 20mm followed by *E.coli* (18mm), *B.megaterium* (15mm) and *B.cereus*(12mm). The antibacterial activity was may be due to the production of acetic and lactic acids that lowered the pH of the medium or competition for nutrients, or due to production of bacteriocin or antibacterial compounds (Bezkorvainy 2001).

Haemolytic activity and oxalate degradation potential

The next assessed was the virulence factor of probiotics i.e., haemolytic activity. From the observed results no isolate showed clear zone of hydrolysis surrounding the colony on the blood agar plates.

Lastly oxalate degradation potential was determined for all the isolates. And here also no zone of oxalate hydrolysis was observed on the MRS medium supplemented with 1% calcium oxalate.

Turroni found that *Lactobacillus acidophilus* and *Lactobacillus gasseri* showed significant oxalate degradation in 5mM oxalate whereas other strains showed less oxalate consumption especially; *Lactobacillus salivarius* which showed 20% oxalate degrading ability (Turroni et al., 2007). Murphy also reported that oxalate utilization among probiotics *in vitro* was interspecies dependent (Murphy et al., 2009)

Identification of the isolates

Identification of the isolates was done by Vitek 2 compact system. Isolate LBCwas identified as *Saccharomyces cervisiae* with 99% probability. Isolate VBT was identified as *Enterococcus hirae* with 99% probability. Isolate LBS was identified as *Bacillus coagulans/ Lactobacillus sporogenes* with 91% probability. Isolate AFC was identified as *Alicyclobacillus*

acidocaldarius/Alicyclobacillus acidoterrestris with 92% probability.

Results And Discussions

Table 1. Showing bile salt tolerance of isolates

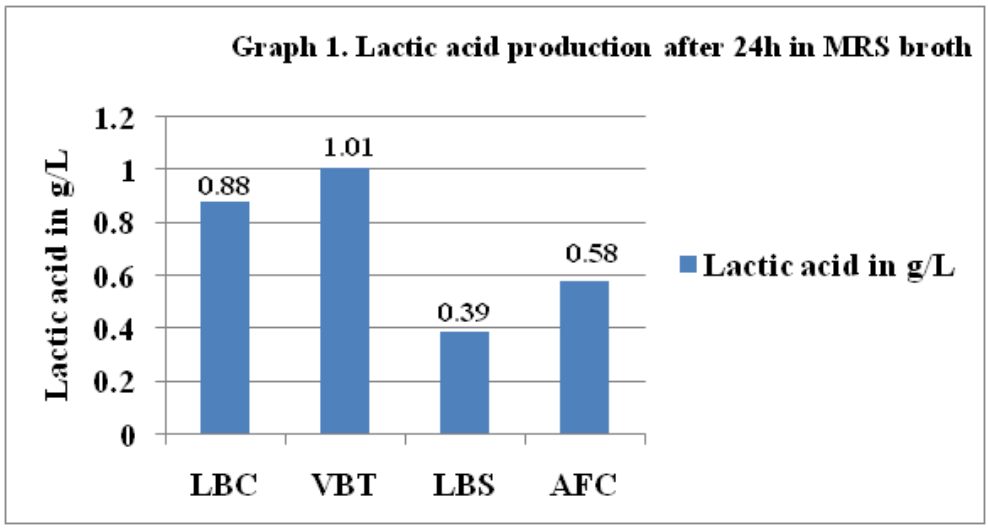
Isolates	0.1%	0.2%	0.5%	1%	1.5%	2%	2.5%
LBC	++++	+++	+++	++	++	+	-
VBT	++	+	-	-	-	-	-
LBS	+++	++	+	+	-	-	-
AFC	++	+	+	-	-	-	-

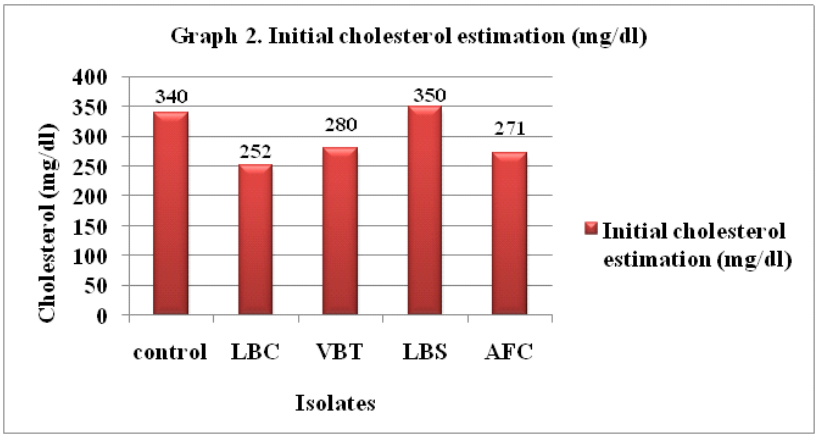
Table 2 Showing NaCL tolerance of isolates

Isolates	NaCL concentrations					
	1%	3%	5%	8%	10%	15%
LBC	1.437	1.288	1.265	0.987	0.486	-
VBT	1.165	1.118	0.900	1.407	-	-
LBS	1.207	1.308	1.367	1.104	-	-
AFC	1.242	1.207	0.712	0.102	-	-

Table 3. Showing results for antibiotic susceptibilty

Antibiotics (mcg)	Diameter in millimeter(mm)			
	Isolate LBC	Isolate VBT	Isolate LBS	Isolate AFC
Ampicillin sulbactum (AS-20)	10	22	23	25
Co-trimoxazole (BA-25)	21	20	17	15
Cephalexin (PR-30)	25	24	20	10
Tetracyclin (TE-30)	7	7	14	22
Cefotaxime (CF-30)	00	00	00	00
Ciproofloxacin (RC-5)	18	19	16	18
Levofloxacin (QB-5)	12	18	23	24
Linezoloid (LZ-30)	14	15	22	20
Cloxacillin (CX-1)	16	18	15	17
Roxythromycin (AT-15)	12	10	12	14
Lincomycin (LM-2)	9	8	13	12
Gentamicin (GM-10)	10	7	9	10





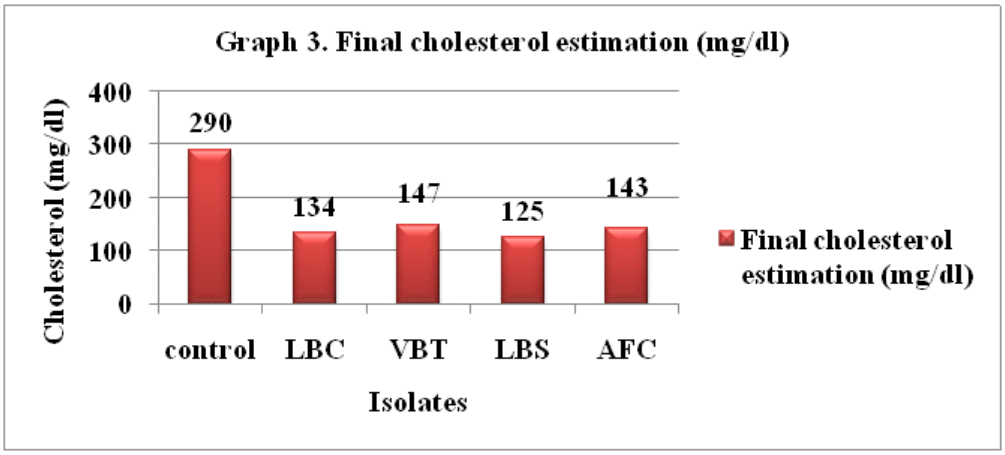
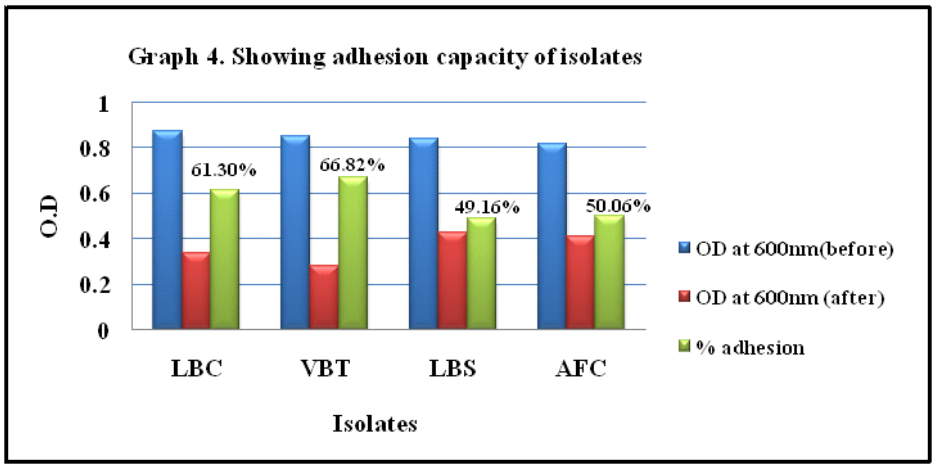


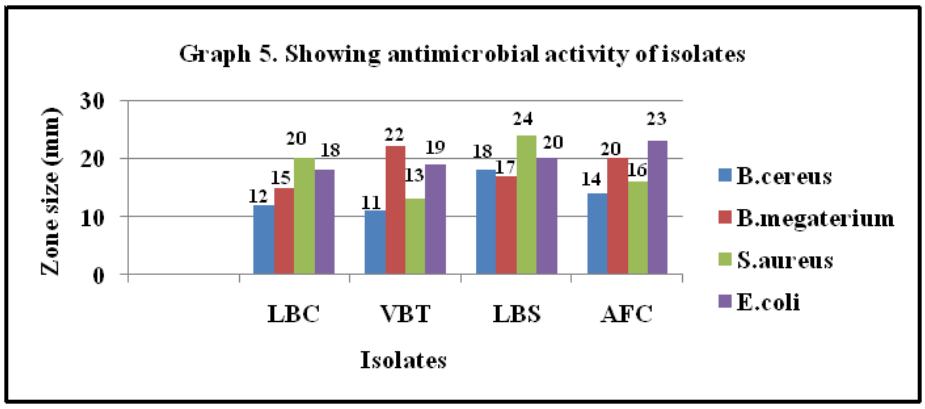
Table 4. Viscosity estimation of isolates

Isolates	Viscosity of fermentation broth in m.pa.sec^{-1}		
	Initial viscosity	Viscosity after 3 days	Viscosity after 5 days
LBC	0.158	1.364	0.382
VBT	0.137	1.280	0.360
LBS	0.161	1.563	1.212
AFC	0.127	1.418	0.371

Table 5. Showing results for EPS production after incubation

Isolates	EPS wet wt g/100ml		EPS dry wt g/100ml	
	After 3 days	After 5 days	After 3 days	After 5 days
LBC	1.367	1.154	1.101	1.087
VBT	1.121	1.078	1.042	1.035
LBS	1.428	1.125	1.115	1.071
AFC	1.169	1.132	1.090	1.064





Identification of the isolates by Vitek 2 compact instrumentation

All the isolates were identified Vitek 2 compact method. The identified isolates were ***Saccharomyces cerevisiae, Enterococcus hirae, Lactobacillus sporogenes/Bacillus coagulans and Alicyclobacillus acidoterrestris/acidocaldarius.***

Conclusion

In the present study, the probiotic isolates were obtained from six different commercial probiotic products. Total four isolates were obtained all of which were gram positive and were carried further for the entire study. The basic aim for the present investigation was to test the commercial probiotic products that claim to contain the efficient probiotics that could confer potential health benefits to humans. The obtained isolates were initially evaluated for their probiotic capabilities and were then further tested for their functional aspects. Hence the commercial products assessed for their probiotic criterias do contain good probiotic organisms that can confer potential health benefits to humans. In addition all the isolates could also be implemented for the animal studies or on animal models for further assessment.

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Original Paper

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Role Of Biofertilizer In Sustainable Agriculture

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Absract

It has become important for us to increase the productivity of plants because of the ever increase in demand of agricultural produce by using various fertilizers, insecticides and pesticides. All the same the tremendous use of these products results in the soil becoming depleted of the essential minerals. So, it has become important to explore ways to overcome this problem. Use of biofertilizers is one such method that can help improve the health of the soil. The green revolution brought impressive gains in food production but with insufficient concern for sustainability. The Government of India has been trying to promote an improved practice involving use of bio- fertilizers along with other fertilizers. These inputs have multiple beneficial impacts on the soil and can be relatively cheap and convenient for use. Biofertilizers make nutrients that are naturally abundant in soil or atmosphere usable for plants.

Keywords: Bio-fertilizer, microorganisms, *Rhizobium*, *Azotobacter*, *Phosphate solubilizing biofertilizes.*

Introduction

About 100 years ago, Hellriegal and Wilfarth demonstrated clearly that fixation of atmospheric nitrogen takes place in legumes, although earlier in 1980s, Boussingault, a French agriculturist, provided the data to show that legumes are superior to cereals in furnishing the

nitrogen to plant. Bio-fertilizers, in strict sense, are not fertilizers, which directly give nutrition to crop plants. These are cultures of microorganisms like bacteria, fungi, packed in a carrier material. Thus, the critical input in biofertilizer is the microorganisms. They help the plants indirectly through better Nitrogen (N) fixation or improving the nutrient availability in the soil. The term "Biofertilizer" or more appropriately

"Microbial inoculants" can generally be defined as preparation containing live or latent cells of efficient strains of Nitrogen fixing, Phosphate solublising or cellulolytic microorganisms used for application to seeds, soil or composting areas with the objective of increasing the number of such microorganisms and accelerate those microbial process which augment the availability of nutrients that can be easily assimilated by plants. In other words, "Biofertilizer is a substance which contains living microorganisms which, when applied to seed, plant surfaces, or soil, colonizes the rhizosphere or the interior of the plant and promotes growth by increasing the supply or availability of primary nutrients to the host plant (Vessey, 2003). This definition separates biofertilizer from organic fertilizer.

Literature Review

For optimum plant growth, nutrients must be available in sufficient and balanced quantities (Chen, 2006). Excessive and inappropriate use of agrochemicals has undeniably resultedin negative and sometimes irreparable effects on the environment and on human health. Degraded soils and groundwater pollution caused by chemical leaching have resulted in nutritionally imbalanced and unproductive lands. The growth in agricultural production during the last three decades has been accompanied by a sharp increase in the use of chemical fertilisers, causing serious concern (Marothia, 1997). Foremost among these concerns is the effect of excessive fertiliser (especially nitrogenous fertilisers) on the quality of soil and ground water. Soil fertility can be restored effectively through adopting the concept of integrated soil fertility management (ISFM) encompassing a strategy for nutrient management-based on natural resource conservation, biological nitrogen fixation (BNF) and increased efficiency of the inputs (Vlek and Vielhauer, 1994).

Biofertilizers are products containing living cells of different types of microorganisms which when, applied to seed, plant surface or soil, colonize the rhizosphere or the interior of the plant and promotes growth by converting nutritionally important elements (nitrogen, phosphorus) from unavailable to available form through biological process such as nitrogen fixation and solubilization of rock phosphate (Rokhzadi*et al*., 2008). Beneficial microorganisms in biofertilizers accelerate and improve plant growth and protect plants from pests and diseases (El-yazeid*et al*., 2007). The role of soil microorganisms in sustainable development of agriculture has been reviewed (Lee and Pankhurst, 1992; Wani*et al*., 1995).

Biofertilizers are usually prepared as carrier-based inoculants containing effective microorganisms. Incorporation of microorganisms in carrier material enables easy-handling, long-term storage and high effectiveness of biofertilizers. Among various types of biofertilizers, bacterial

inoculant is one major group which includes rhizobia, nitrogen-fixing rhizobacteria, plant growth-promoting rhizobacteria, phosphate-solubilizing bacteria, and so on.

Basically, the carrier-based inoculant of these bacteria can be prepared by a common procedure. Most of the bacteria included in biofertilizer have close relationship with plant roots. *Rhizobium* has symbiotic interaction with legume roots, and rhizobacteria inhabit on root surface or in rhizosphere soil. To achieve the successful inoculation of *Rhizobium* or rhizobacteria, large population of the bacterial strain must be placed close to the emerging root, so that the majority of nodules are formed by the inoculated rhizobial strain, and that the inoculated rhizobacterial strain occupies the rhizosphere as major member of rhizobacteria. If the population is not large enough, the native rhizobia / rhizobacteria will occupy most of the root nodules / rhizosphere, leading to unsatisfactory effect of inoculation.

The most common way of inoculation is "seed inoculation", in which the inoculant (bacteria-carrier mixture) is mixed with water to make slurry-form, and then mixed with seeds. In this case, the carrier must be a form of fine powder. To achieve the tight coating of inoculant on seed surface, use of adhesive, such as gum arabic, methylethylcellulose, sucrose solutions, and vegetable oils, is recommended. Any locally available sticky material, which is non-toxic to bacteria and seeds, can be used as adhesive. Seed inoculation may not always be successful, i.e. the inoculation resulted in low nodule In India the first study on legume.

Rhizobium symbiosis was conducted by N.V.Joshi and the first commercial production started as early as 1956. However, the Ministry of Agriculture under the Ninth Plan initiated the real effort to popularize and promote the input with the setting up of the National Project on Development and Use of Biofertilizers (NPDB). Commonly explored biofertilizers in India are mentioned below along with some salient features.

Rhyzobium (RHZ): These inoculants are known for their ability to fix atmospheric nitrogen in symbiotic association with plants forming nodules in roots. RHZ are however limited by their specificity and only certain legumes are benefited from this symbiosis. *Rhizobium* multiplication in carrier in ambient temperature up to 90 days. Carrier sterilization contributed significant increase in grain yield, nodule number and nitrogen content. It can be stored in a dry state without losing much viability.

Azotobacter (AZT): This has been found beneficial to a wide array of crops covering cereals, millets, vegetables, cotton and sugarcane. It is free living and non-symbiotic nitrogen fixing organism that also produces certain substances good for the growth of plants and antibodies that suppress many root pathogens. *Azospirillum (AZS):* This is also a nitrogen-fixing micro organism beneficial for non-leguminous plants. Like AZT, the benefits transcend nitrogen enrichment through production of growth promoting substances.

Blue green Algae (BGA) and Azolla: BGA are photosynthetic nitrogen fixers and are free living. They are found in abundance in India i. They too add growth-promoting substances including vitamin B12, improve the soil's aeration and water holding capacity and add to bio

mass when decomposed after life cycle. Azolla is an aquatic fern found in small and shallow water bodies and in rice fields. It has symbiotic relation with BGA and can help rice or other crops through dual cropping or green manuring of soil.

Phosphate solubilizing (PSB)/Mobilizingbiofertilizer: Phosphorus, both native in soil and applied in inorganic fertilizers becomes mostly unavailable to crops because of its low levels of mobility and solubility and its tendency to become fixed in soil. The PSB are life forms that can help in improving phosphate uptake of plants in different ways. The PSB also has the potential to make utilization of India's abundant deposits of rock phosphates possible, much of which is not enriched. the use of PSB in agricultural practice would not only offset the high cost of manufacturing phosphate fertilizers but would also mobilize insoluble in the fertilizers and soils to which they are applied (Chang and Yang, 2009; Banerjee *et al*., 2010).

Mycorrhiza inoculums are the biofertilizer that is increasingly being utilized and accepted in agriculture industry of Malaysia. Large scale productions of biofertilizer are produced mainly for supplying nutrient, amelioration of toxic effect in soils, root pest and disease control, improved water usage and soil fertility (Abdul Halim, 2009). While *Rhizobium*, Blue Green Algae (BGA) and *Azolla*are crop specific, bio-inoculants like *Azotobacter,Azospirillum*, Phosphorus Solubilizing Bacteria (PSB), VesicularArbuscularMycorrhiza (VAM) could be regarded as broad spectrum biofertilizers (Gupta, 2004).

The phospho-microorganism mainly bacteria and fungi make insoluble phosphorus available to the plants (Gupta, 2004). Several soil bacteria and a few species of fungi possess the ability to bring insoluble phosphate in soil into soluble forms by secreting organic acids (Gupta,2004). These acids lower the soil pH and bring about the dissolution of bound forms of phosphate.

As biofertilizers contain living organisms, their performance, therefore, depends on surrounding environment. Hence, outcomes are bound to be inconsistent (Rahim, 2002). Government research institute, the Malaysian Rubber Board (MRB) had been conducting research on *Rhizobium* inoculums for leguminous cover crops in the inter rows of young rubber trees in the large plantations. Besides, University Putra Malaysia (UPM) also has conducted many researches since 1980's on *Mycorrhiza*and initiated the research to evaluatethe contribution of nitrogen from *Azospirillum* to oil palm seedlings (Abdul Halim, 2009).

Table-1: Major Biofertilizers and target crops

Biofertilizers	**Target crop**
Rhizobium	Leguminous crops (Pulses, oilseeds, fodder)
Azatobacter	Wheat, rice, vegetables
Azospirillum	rice, sugarcane
Blue green algae (BGA)	Rice
Azolla	Rice
Phosphate solubilising microorganisms (PSMs)	All

The potential of biofertilizers is evidenced by the fact that about 90% of Haryana's soil is deficient in nitrogen, indicating severe nutrient deficiency (Dahiya *et al.*, 1993). Biofertilizers can also reduce the intensity of chemical fertiliser consumption, especially in irrigated areas.

Conclusion

Biofertilizers can provide an economically viable support to small and marginal farmers for realizing the ultimate goal of increasing productivity. Biofertilizers are low cost, effective and renewable source of plant nutrients to supplement chemical fertilizers. In nature, there are a number of useful soil microorganisms that can help plants to absorb nutrients. Their utility can be enhanced with human intervention by selecting efficient organisms, culturing them and adding them to soils directly or through seeds. The cultured microorganisms packed in some

carrier material for easy application in the field are called biofertilizers. Bio-fertilizers are living microorganisms of bacterial, fungal and algae origin. Their mode of action differs and can be applied alone or in combination. Biofertilizers enhance the nutrient availability to crop plants (by processes like fixing atmosphere N or dissolving P present in the soil); and impart better health to plants and soil thereby enhancing crop yields in a moderate way. It is a natural method without any problems like salinity and alkalinity, soil erosion etc.. In the vast areas of low input agriculture and oil seeds production, as also in crops like sugarcane, etc, these products will be of much use to give sustainability to production.

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Bacterial Decolourization & Degeradation Of Reactive Red 35: A Brief Treatise.

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Abstract

Environmental pollution is one of the major and most important problems of modern world. Increasing industrialization for fulfilling the need and demand of overgrowing human population lead to the production of environmental pollutants. These pollutants are released into the environment and causes detrimental effects on the humans, plants, animals, microbes and ecosystem integrity. We must focus our attention on ways for the eradication and reduction of pollution (Hazrat, 2010). The textile industry is the one of the major greatest generators of liquid effluent pollutants, due to high quantities of water used in the dyeing processes. It is estimated that 2,80,000 tons of textile dyes are discharged in such industrial effluents every year worldwide (Saratale *et al*.,2011). Azo dyes are the most widely used dyes and represent over 60-70% of the total dyes (Solis *et al*., 2012). Azo dyes in general can be defined as ones which have, chromophoric azo group (-N=N-) attached to an aromatic or heterocyclic nucleus at one end and an unsaturated molecule of carbocyclic, heterocyclic or aliphatic type at the other end. These dyes are found to be largest classification of dyes with the Color Index (CI) of more than 10,000 (Ghaly *et al*., 2014). During the dying process all the dye does not bind to the fabrics; and release (2-50%) in effluent. The existence of azo dyes and its intermediates in aqueous ecosystems leads to aesthetically unacceptable coloration of waters, and reduced sunlight penetration, photosynthetic

activity, dissolved oxygen leveland consequently leading to death and putrefaction of aquatic animals (Agrawal *et al*., 2014). Therefore, treatment of textile wastewater is necessary prior to discharge.

Traditional treatment methods utilized for treatment of textile wastewater are having several limited applications and drawbacks. Biological treatment methods appear to be a promising technology for treatment of textile wastewater in eco-efficient manner. Uses of microbial technology for treatment of textile wastewater have several advantages, such as environmentally friendly, cost competitive, producing less sludge, efficient mineralization in less toxic or non-toxic compounds with combination of different treatment and less input of chemicals and water for treatment (Christian *et al*., 2005; Hazrat, 2010; Solis *et al*., 2012).

The effectiveness of microbial treatment of textile wastewater lies on the ability of the selected microorganisms to decolorize and degrade the dye present in it. Microbes acclimatize themselves to the toxic pollutants and develop natural resistance and transform them into less harmful forms (Saratale *et al*., 2011). A wide variety of microorganisms, including bacteria, fungi, yeasts, actinomycetes, and algae are capable for decolorization and degradation of dyes (Agrawal *et al*., 2014; Pandey *et al*., 2007). Under facultative and anaerobic conditions, bacterial degradation of azo dyes is initiated generally by cleavage of azo bonds resulted in the formation of colorless aromatic amine and its derivatives, which are mutagenic and toxic and cannot be metabolizedeasily under the same conditions under which they produce. They are generally degraded under aerobic condition (Balapure *et al*., 2014). So combination of different treatment methods must be exploited for effective biodegradation of textile wastewater. Thus, the bacterial population employed in a treatment of dye containing wastewater must be able to work under both anaerobic/microaerophilic and aerobic conditions to obtain efficient degradation of azo dyes (Balapure *et al*., 2014). Utilization of synergistic effect of mixed bacterial population for treatment of textile wastewater has advantages of effective mineralization of dyes (Jain *et al*., 2012).The immobilization of microbial cultures on inert carrier materials in bioreactor for large scale treatment of textile wastewater has widened their applications and improved their performance, stability against higher organic loading rate (Balapure *et al*.,2015; Lade *et al*., 2015).

Thus, in a light of the above discussion and need to develop an efficient method for the treatment of textile wastewater with potent microbial cultures,different potential bacteria having the capability to decolorize and degrade the textile dyes were isolated and their performance were enhanced by optimizing process parameters.Potent bacterial isolates were also applied for reactor scale study for the treatment of textile wastewater. Briefly, the entire study for microbial decolorization of azo dyes was aimed with the following objectives:

- Screening and isolation of bacteria capable of decolorizing azo dyes.
- Identification and characterization of azo dye decolorizing bacteria.
- Assessment of ability of potent bacterial isolates to decolorize different azo dyes.
- Assessment of dye decolorization performance of potent bacterialisolates in mixture with

other isolates.

- Optimization of physico-chemical parameters to increase dye decolorization performance of bacterial isolates.
- Determination of enzyme responsible biodegradation of dye.
- Study the biodegradation mechanism of dye.
- Reactor scale study for treatment of azo dye containing textile wastewater.
- Toxicity assessment of treated dye and textile wastewater.

To fulfill above objectives, present research work was initiated with the isolation and screening of dye decolorizing bacteria.Reactive Red 35 (RR35), a vinyl sulphone based monoazo dye, widely utilized in textile dyeing was selected as a model dye for study. Fifteen different soil/ sludge and wastewater samples, from dyecontaminated siteswere collected. From these samples total eighty-three different bacteria were isolatedby enrichment culture technique using Bushnell Hass medium (supplemented with 2.5 g/L yeast extract and 100 mg/L of RR35). These bacterial isolates were screened for their RR35 dye decolorizing ability at 100 mg/L concentration, and five potent bacterial isolates (showing >70% dye decolorization) were selected for further study and characterized by cultural, morphological and with different biochemical tests. They are identified with 16S rRNA sequence, as *Pseudomonas aeruginosa* ARSKS20,*Enterococcus gallinarum* NRK, *Pseudomonas aeruginosa* PKS, *Bacillus cereus* AJS1,and *Lysinibacillus macroides*ARS5and the gene sequence were submitted to GenBank at NCBI with GenBank Accession number JN817386.1,KC814158.1,KR706564, KR706562 and KR706563, respectively. Antibiotic susceptibility testing of these five potential bacterial isolates were also carried out. They are sensitive towards wide spectrum range of antibiotics.

Each of these five bacterial isolates individually and in combination with other pure cultures (among five) were tested for their RR35 dye decolorization ability. Individually, pure cultures of *P. aeruginosa* ARSKS20,*E. gallinarum* NRK, *P. aeruginosa* PKS, *B. cereus* AJS1, and *L. macroides*ARS5were showing83.02, 88.88, 72.23, 70.66 and 71.98% decolorization of RR35 at 100 mg/L concentration, respectively, after 24 h at 35±2°C, under static condition. The bacterial mixture of two best potent isolates*P. aeruginosa* ARSKS20 and *E. gallinarum* NRK (designated as MBR1) showed 95.54, 94.02 and 92.19% decolorization of 100, 300 and 500 mg/L of RR35 respectively, after 24 h of incubation. The bacterial mixture of *P. aeruginosa* ARSKS20, *E. gallinarum* NRK, *B. cereus* AJS1and *L. macroides*ARS5(designated as MBR2) showed 99.56, 98.09 and 97.53% decolorization of 100, 300 and 500 mg/L of RR35 respectively, after 24 h of incubation. Thus, nearly complete decolorization was observed with the bacterial mixture-MBR2 even at 500 mg/L RR35 concentration, it might be due to co-metabolism among bacteria, which was of major interest for large scale treatment of textile effluent.

Two most potential cultures *P. aeruginosa* ARSKS20 and *E. gallinarum* NRKwere also assessed for their ability to decolorize different azo dyes at 100 mg/L concentration. The results

suggest that *P. aeruginosa* ARSKS20 can decolorize thirteen different azo dyes, while *E. gallinarum* NRK can efficiently decolorizeeleven different azo dyes. Both potent isolates decolorized RR35 at fastest rate than the other dyes. Thus, further detailed investigation for decolorization and degradation dye was carried out with of RR35 dye by pure cultures of *P. aeruginosa* ARSKS20 and *E. gallinarum* NRK.

Optimization of physico-chemical parameters for RR35 dye decolorization by *P. aeruginosa* ARSKS20 was carried out with one parameter at a time approach. Dye decolorization performance of *P. aeruginosa* ARSKS20 was assessed under various environmental parameters such as static *vs* shaking condition (120 rpm), initial dye concentrations (50–500 mg/L), pH values (4–11) and temperatures (25–50˚C), inoculum size (1-10%, v/v) and in the presence of different supplemental carbon and nitrogen sources. *P. aeruginosa* ARSKS20 decolorized RR35 only under static condition. It shows maximum 95.11% decolorization of RR35 at a rate of 8.27 mg/L/h at 40˚C, pH 8, under static condition at 100 mg/L concentration. 5% (v/v) inoculum volume of *P. aeruginosa* ARSKS20was proved as an optimum for RR35 dye decolorization. *P. aeruginosa* ARSKS20 showedthe obligatory requirement of yeast extract for RR35 decolorization and utilized yeast extract as both carbon and nitrogen source. It can tolerate upto 50 g/L NaCl concentration and shows 90% dye decolorization at a rate of 2.41 mg/L/h.The decolorization of repeated addition of dye aliquots (100 mg/L) to culture media was also studied. Under optimized conditions, it could efficiently decolorize RR35 with increasing rate upto twelve repeated dosing without supplementation of new nutrients. Growth and dye decolorization ability of *P. aeruginosa* ARSKS20 is strongly affected in presence of metals. Inpresent study effect of chromium, nickel, cobalt and copper were assessed. Growth and dye decolorization ability of *P. aeruginosa* ARSKS20were adversely affected at 1.9 mM of Cr(VI), 7.5 mM of Ni(II), 6.5mM of Co(II) and 0.5 mM of Cu(II).

The enzyme profile study of*P. aeruginosa* ARSKS20 during RR35 decolorization, shows significant induction in the activities of laccase (20%), lignin peroxidase (24%), tyrosinase (106%), veratryl alcohol oxidase (260%), NADH–DCIP reductase (33%), and azoreductase (139%)enzymes suggest their active involvement in RR35 dye decolorization. Decolorization and degradation of RR35 by *P. aeruginosa* ARSKS20was demonstrated through UV-visible spectral scanning, HPLC, HPTLC, and FTIR analysis. The biodegradation mechanism of RR35 by *P. aeruginosa* ARSKS20is predicted with the help of GC-MS analysis. The GC-MS analysis of metabolites obtained after decolorization suggest, RR35 is degraded into 1-amino-2-hydroxy-5-[2-(sulphooxy ethyl)] benzene, 1-amino-2-methoxy-5-[2-(hydroxy)ethyl] sulphonyl benzene, 1-amino-2-methoxy benzene, 2-amino-8-(acetylamino) naphthalen-1-ol, naphthalene-1-7-diamine, 2-amino naphthalen-1-ol and naphthalene.

The toxicological studies of metabolites obtained after RR35 degradation by *P. aeruginosa* ARSKS20 were performed with various techniques, viz. microbial toxicity with*Bacillus subtilis* (MTCC 1305) and *Azotobacter chroococcum* (MTCC 7724); cytogenotoxicity, comet assay, antioxidant enzyme status, protein oxidation, lipid peroxidation with *Allium cepa* assay; and

phytotoxicity with *Sorghumbicolor, Triticum aestivum* and *Phaseous mungo.* The toxicity studies collectively conclude the non-toxic nature of metabolites obtained after degradation of RR35. Thus, *P. aeruginosa* ARSKS20 candecolorize and degrade RR35 dye efficiently into non-toxic low molecular weight compounds and it can be further utilized for eco-friendly treatment of textile wastewater at larger scale.

Optimization of physico-chemical parameters for RR35 dye decolorization by *E. gallinarum* NRKwas carried out with one parameter at a time approach.Dye decolorization performance was assessed under various environmental parameters such as static *vs* shaking condition, initial dye concentrations (50–500 mg/L), pH values (4–11), temperatures (25–50˚C) and in presence of different supplementalcarbon and nitrogen sources. *E. gallinarum* NRKshowed very poor dye decolorization under shaking condition. It showed maximum 96% decolorization of RR35 at a rate of 76.81 mg/L/h at 40˚C, pH 7, under static condition at 300 mg/L RR35 concentration.Yeast extract at 5 g/L concentrations (with 5% (v/v)inoculum) was proved as an optimum concentration for RR35 dye decolorization. Isolate could efficiently decolorize RR35 (85.38%) at higher salinity (40 g/L) with a rate of 68.30 mg/L/h. The dye decolorization capacity of *E. gallinarum* NRK was evaluated with repeated spiking of 300 mg/L RR35 dye. Under optimized conditions, it could efficiently decolorize RR35 with increasing rate upto repeated dosing without supplementation of new nutrients.

The enzyme profile study of*E. gallinarum* NRKduring the RR35 decolorization showedsignificant induced activities of intracellular laccase (35%), extracellular laccase (438%), intracellular tyrosinase (75%), extracellular tyrosinase (226%), lignin peroxidase (Lip) (75%), veratryl alcohol oxidase (43%), NADH–DCIP reductase (25%), and azoreductase (418%) enzymes.

Decolorization and degradation of RR35 by *E. gallinarum* NRKwas demonstrated through UV-visible spectral scanning, HPTLC and FTIR analysis. The biodegradation mechanism of RR35 by *E. gallinarum* NRKis predicted with the help of GC-MS analysis. The GC-MS analysis of metabolites obtained after decolorization suggest, RR35 is degraded into1-amino-3-[2-(sulphooxy)ethyl]sulphonyl benzene, 2-amino-8-(acetylamino)naphthalen-1-ol and naphthalene 1,7-diamine. Toxicological studies of metabolites obtained after RR35 degradation by *E. gallinarum* NRK were performed with various techniques, viz. cytogenotoxicity, comet assayin*Allium cepa* and phytotoxicitywith *T. aestivum, P. glaucum, P. mungo* and *V. radiata.*The toxicity studies collectively conclude non-toxic nature of metabolites obtained after degradation of RR35.Thus, *E. gallinarum* NRK candecolorize and degrade RR35 dye very efficiently and it can be further appliedfor eco-friendly treatment of textile wastewater.

Scale-up study was carried out with microaerophilic downflow fixed film reactors and with sequential anaerobic-plugflow fixed film reactor/aerobic-airlift fixed film reactor. Furnace charcoal was used as packing materials for biofilm development.

For scale up study, textile waste water was collected from Global Dyeing and Printer,

Behrampura, Ahmedabad.This wastewater was collected during the dyeing of purple color shading on cotton sheets (cloths) for which they have utilized Reactive Red 35 (RR35) and Reactive Blue 160 (RB160) dyes for developing their purple color shade. Thus, collected wastewater was the residual mixture of Reactive Red 35, Reactive Blue 160 dyes and other ingredients utilized for dyeing. Collected textile wastewater was analyzed for its physico-chemical characteristics, and it showed alkaline pH (9.0 ± 0.4), high total solids (TS) and total dissolved solids (TDS)content with chemical oxygen demand (COD) and biological oxygen demand (BOD) value of 1920 ± 250 mg/L and 495 ± 85 mg/L, respectively.

The microaerophilic treatment of textile wastewater was carried out with the establishment of two different microaerophilic downflow fixed film reactors (DFFR). One microaerophilic Downflow fixed film reactor (DFFR1) was established with biofilm formation of active mixed culture MBR1, which contains mixed bacterial cultures of *P. aeruginosa* ARSKS20 and *E. gallinarum* NRK. The second microaerophilic downflow fixed film reactor (DFFR2) was established with biofilm formation of active mixed culture MBR2, which containedbacterial cultures of *P. aeruginosa* ARSKS20, *E. gallinarum* NRK, *B. cereus* AJS1, and *L. macroides*ARS5 (isolated during the initial phase of this study).Both microaerophilic DFFR1 and DFFR2 were operated with organic loading rate (OLR) of 0.088-2.2 kg COD/m^3/d after development of active biofilm.Maximum ADMI (American Dye Manufacturer's Institute) removal 95.45 and 96.02% observed in DFFR1 and DFFR2, respectively, with OLR of 0.44 kg COD/m^3/d. BOD removal in DFFR1 and DFFR2 were obtained in the range from 90-64.03% and 91.33-74.24%, respectively. COD removal in DFFR1 and DFFR2 was obtained in the range from 79.88-59.55% and 83.68-64.89%, respectively. Alkalinity and pH were increased with increasing OLR. . Maximum TS and TDS removal were 67.21 and 68.13%; and 68.52 and 70.78%, respectively obtained in DFFR1 and DFFR2 at 0.264 kg COD/m^3/d OLR. Higher induced enzyme activities of azoreductase, veratryl alcohol oxidase, tyrosinase and lignin peroxidase were observed in DFFR2 in comparing to DFFR1. Moderately higher induced activities of NADH-DCIP reductase was observed in DFFR1 than DFFR2. Degradation of dyes present in textile wastewater was confirmed through UV- visible spectral scanning, HPTLC and FTIR analysis. With the help of GC-MS analysis probable degradation mechanism of RR35 and RB160 dyes (present in textile wastewater) during microaerophilic treatment are elucidated. The formation and disappearance of different metabolites of RR35 and RB160 during different HRT of DFFR1 and DFFR2 were studied with GC-MS analysis. Results suggest that the intermediates formed from the initial cleavage of RR35 and RB160 were detected during 1 d and 2 d HRT, and sequentially formed lower molecular weight compounds and some complex compounds were detected during 3 d and 5 d HRT.

The toxicological studies of treated (with DFFR1 and DFFR2) textile wastewaters were carried out by phytotoxicity and their effect on soil fertility properties. Phytotoxicitystudies with *V. radiata, P. mungo* and *T. aestivum*conclude non-toxic nature of treated textile wastewater. Toxicological effects on soil fertility upon utilization of treated (with DFFR1 and DFFR2) and

untreated textile wastewater were assessed with various parameters, viz. soil pH, conductivity, N,P,K value, soil enzyme activity (acid phosphatase, alkaline phosphatase, dehydrogenase), the number of soil bacteria (amylase and lipase producing bacteria, and *Azotobacter* sp.). The overall results suggest that after treatment with DFFR1 and DFFR2, textile wastewatersare safe for disposal on land and utilization for irrigation purpose along with normal water.

The anaerobic and sequential anaerobic/aerobic treatment of textile wastewater was carried out with uniquely designed anaerobic-plugflow fixed film reactor(PFFR)/aerobic-airlift fixed film reactor(AFFR). Anaerobic-PFFR were operated 2-6 d hydraulic retention time (HRT) (OLR of 0.33-0.99 kg COD/m^3/d) and effluent of PFFR sequentially treated for more 2 d with aerobic-AFFR. Thus, combined anaerobic/aerobic treatment (with PFFR/AFFR) were operated collectively by 4-8 d HRT. Anaerobic treatment of textile wastewater showed 96-95% ADMI removal during OLR of 0.33-0.99 kg COD/m^3/d. During subsequent aerobic treatment, no remarkable ADMI removal was observed. COD removal during anaerobic and with sequential aerobic treatment was observed in range, from 80.14- 50.87%, and 84.37-64.06%, respectively. BOD removal during anaerobic and with sequential aerobic treatment was observed in range, from 84.51-72.54%, and 95.77-80.28%, respectively. The higher efficiency of sequential anaerobic/aerobic treatment was observed with higher OLR and at shorter retention time. Sequential anaerobic/aerobic treatment showed efficient removal of total solid and total dissolved solid even at increasing OLR. Decreased alkalinity was observed after sequential anaerobic/ aerobic treatment. It might be due to degradation of amine during subsequent aerobic treatment. During anaerobic treatment, maximum 23.08% methane content was observed during OLR of 0.49 kg COD/m^3/d and at 4 d HRT.

Anaerobic degradation of RR35 and RB160 present in textile wastewater were confirmed through UV- visible spectral scanning, HPTLC and FTIR analysis. The probable degradation mechanism of RR35 and RB160 dye during anaerobic treatment are elucidatedwith the help of GC-MS analysis. The formation and disappearance of different metabolites from degradation of RR35 and RB160 during different HRT (2, 3 and 6 d) of anaerobic PFFR were studied with GC-MS analysis. High molecular weight intermediates and intermediates formed duringthe initial cleavage of RR35 and RB160 were detected 2 d and 3 d HRT, and sequentially formed lower molecular weight compounds and some complex compounds were detected during 6 d HRT.

Sequential degradation of metabolites under aerobic treatment with AFFR was confirmed through UV- visible spectral scanning, HPTLC and FTIR analysis. Degradation of these metabolites under aerobic treatment (with aerobic-AFFR) was evaluated by comparing the metabolites those were formed during the 6 d HRT treatment with anaerobic PFFR, with the metabolites detected after its sequential treatment (for 2 d) under aerobic AFFR. Results show that initial total sixteen compounds are detected after 6 d anaerobic treatment with PFFR. From these only five compounds [(1)2-amino benzene- 1,4-disulphonic acid; (2)2,5-diamino benzene-1,4-disulphonic acid; (3)2-amino-8-(acetylamino) naphthalen-1-ol; (4)1-amino-3-[2-(sulphooxy) ethyl] benzene; (5)1-amino-3-[2-(sulphooxy)ethyl]sulphonyl benzene]are left out after subsequent

aerobic treatment with AFFR, and remaining eleven compounds may be transformed or degraded during aerobic treatment. Thus, sequential anaerobic/aerobic treatment of textile wastewater, provides very efficient mineralization of textile wastewater.

The toxicological evaluation of textile wastewater after anaerobic and sequential anaerobic/ aerobic treatment were performed by analyzing various parameters, viz. % seed germination (after 5 d), plumule, radical and fibril length, number of legume formation (after 50 d) during phytotoxicity testing with *V. radiata*. Results suggest the toxic effect of untreated textile wastewater was reduced after anaerobic treatment, which was further reduced very efficiently after sequential aerobic treatment.

From the present investigation following conclusions are derived:

- Pure cultures of *P. aeruginosa* ARSKS20 and *E. gallinarum* NRK can efficiently decolorize and degrade Reactive Red 35 dye and are also capable to decolorize wide spectrum of azo dyes.
- Mixed bacterial cultures of (1) *P. aeruginosa* ARSKS20 and*E. gallinarum* NRK;and(2) *P. aeruginosa* ARSKS20, *E. gallinarum* NRK, *B. cereus* AJS1, and *L. macroides*ARS5, can efficiently decolorize, degrade and detoxify textile wastewater with microaerophilic downflow fixed film reactor.
- Sequential anaerobic/aerobic treatment of textile wastewater with anaerobic plugflow fixed film reactor/aerobic airlift fixed film reactor can give a higher efficient treatment of textile wastewater with higher organic loading rate and efficiently reduced toxicity of textile wastewater and provide best eco-friendly remediation of textile wastewater.

Thus, microbial treatment of azo dyes and azo dyes containing textile wastewater is the most efficient eco-friendly treatment approach tobe utilized for larger scale treatment.

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Original Paper

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Smart Cities: The Future of our Country

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Abstract

The term "Smart City" refers to the digitization of many day to day tasks in which citizens are involved. It should integrate the technology with the system, so as to derive a well-organized system. Here we describe the concept of Smart Cities in other countries and in India and what are the initiatives taken by the Government towards the betterment of society.

Currently 31% of India's population is urbanized and these cities generate 63% of the nation's economic activity. These numbers are rapidly increasing, with almost half of India's population projected to live in its cities by 2030[2, 11].

Driven by rising urbanization and fueled by technologies such as Internet of Things (IoT) and data analytics, Smart cities are the cusp of explosive growth. Urbanization requires up gradation of cities in form of better living, managed traffic and in turn managed city. The concept which emerged a few years back was of "E-Governance "which was the effort to bring the required data on-line. Similarly now when we are moving towards the Smart city concept , we are trying to integrate the Technology (ICT) and all the important systems like Traffic management, Waste Management , Water Supply , Sanitation , Electricity etc.

Definition

City can be defined as smart when investments in human and social capital and traditional and modern (ICT) communication infrastructure fuel sustainable economic development and a

high quality of life, with a wise management of natural resources, through participatory governance.[6,10]

There are various definitions available on the web, but none of them could be considered a fixed or standard definition for Smart city as the term changes from country to country or may be it might be viewed differently state wise. But the Smart city would definitely involve urbanization and should have Smart solutions to cities core systems which should include everything from governance to transport, electricity, sanitization, water, traffic and many more such basic facilities for a smart infrastructure.

The term "Electronic city" was proposed in 1994 in a conference about Digital city. This program was administered in 1996 in some European cities like Helsinki and Amsterdam. Electronic city that developed along with the development of IT during the recent decades, entered the social and economic arena for the use of IT and communication for the purpose of providing onetime and direct services for citizens; 24 hours a day[4,12]. If we label a city as "Smart City" it should imply that it will be a sustainable and livable city.

The concept of Smart city is not new, but recently it has grabbed a lot of attention. With increased urbanization, there is a growing demand of improved and better lifestyle.

By 2030, India's economy is expected to have grown five times, beyond largely by the country's urban centers. During the same period the country's urban growth is expected to grow by 270 million, with urban jobs accounting for 70% of that growth[5].

GIFT City: Gujarat International finance Tech-city

One of the earliest city which was considered for development as of a Smart city was GIFT city near Ahmedabad in Gujarat. The aim was to build it as a financial hub.

Gujarat International Finance Tec-City or GIFT is a central business district in the Indian state of Gujarat. Its main purpose is to provide high quality infrastructure (electricity, water, gas, roads, telecoms) so that finance and tech terms can relocate their operations from various cities where infrastructure is either inadequate or expensive. It will have special economic zone, International education zone, integrated townships, Entertainment zones, malls, Stock exchange, and Software Technology park and service units. The city is under construction. It will be built on 986 acres of land [4,13,15,17].

The project is located on the bank of the river and is around 12 km from Ahmedabad International Airport.

Employment base: approximately 600000.

Target completion date: 2020.

The only limitation with GIFT city in present situation is, it lacks urbanization.

Government Initiatives

A city in which ICT is merged with traditional infrastructures and is integrated using the new digital technologies which provide easy ways to manage the community, helps in governance,

is in the race of smart city.

The Government has initiated the Smart city Project for some major cities of India which promises the best lifestyle for the citizens of India.

We outline the proposed project areas initiated by Government of India in building smart cities. Hence, we first list the "20 Smart Cities selected in the First Round challenge by Government"[1]Of the 98 cities and towns that five years down will graduate into smart cities, 24 are capital cities, another 24 are business and industrial centers, 18 are culture and tourism influenced areas, five are port cities and three are education and health care hubs[1,13,15].

These will be the first 20 smart cities in India:

1. Bhubaneshwar	*11. Indore*
2. Pune	*12. NDMC*
3. Jaipur	*13. Coimbatore*
4. Surat	*14. Kakinada*
5. Kochi	*15. Belagavi*
6. Ahmedabad	*16. Udaipur*
7. Jabalpur	*17. Guwahati*
8. Visakhapatnam	*18. Chennai*
9. Solapur	*19. Ludhiana*
10. Davanagree	*20. Bhopal*

Figure 1: List of First 20 Smart Cities

Apart from the above list, Gandhinagar has been shortlisted as one of the hundred cities by Ministry of Urban Development (MoUD) to participate in the Smart City Challenge.

The Gandhinagar project is part of the Gujarat government's initiative to develop some cities as smart cities. Sterlite Technologies is among the early companies to have bagged a smart city project. Sterlite, said senior official of the company, has bagged contract from Gandhinagar. The contract entails creating a Wi-Fi city, with applications like smart parking and lighting [3, 18,19].

Smart Solutions

In or der to guide the cities in development, the Government has proposed some Smart solutions for the states to implement the Smart city project.

Following is the list of Smart Solutions which are proposed by Government for each and every sector. The city which will be able to effectively utilize the resources for all the said solutions will remain in the race of smart city.

Fig 2: Smart Solutions [1,14]

Accordingly, the purpose of the Smart Cities Mission is to drive economic growth and improve the quality of life of people by enabling local area development and harnessing technology, especially technology that leads to Smart outcomes. Area- based development will transform existing areas (retrofit and redevelop), including slums, into better planned ones, thereby improving livability of the whole City. New areas (Greenfield) will be developed around cities in order to accommodate the expanding population in urban areas. Application of Smart Solutions will enable cities to use technology, information and data to improve infrastructure and services. Comprehensive development in this way will improve quality of life, create employment and enhance incomes for all, especially the poor and the disadvantaged, leading to inclusive Cities[1].

The Government has also guided the cities with the Area Based Strategies (ABD) to implement the solutions for Fast Track Smart cities. We list a few of them here.

Redevelopment- Affordable Housing

Retrofitting – Open space management, Lake River Sea-Shore Protection.

Retrofiting – Heritage Areas

GIS based property and land management system.

Robust IT connectivity

Good E-Governance

The researchers continuously meet to discuss the growth potentials in the Smart City Expo in Delhi. The recent expo which was held in May 2016 discussed about the urbanization and expected growth in the coming years.

The three day expo focuses mainly on smart urban planning, Smart water solutions, Public transport and Waste management solutions. It witnessed support from ministries, public and private companies in India and across the globe. The speakers shared their expertise on Smart cities vision [20].

It is indeed a good initiative that the Smart solutions are already registered. The government is of course taking the initiatives and guiding the cities for development, but we as citizens should also strive for making our city smart. If each and every citizen decides to contribute his best, then we can observe a substantial improvement in entire city and entire nation.

Smart Citizen

We are thriving to build Smart cities, but before that we must thrive to be "Smart Citizens". The effects of smart city initiatives will only be visible if all of us understand our basic responsibilities of "Maintaining"our city. The term Maintaining includes

Keeping our city clean

Following Traffic Discipline

Keeping the Nation Corruption free

Using Nation's and Nature's Resources Wisely

Respect for Every fellow Citizen

Following Parking Initiatives by the Government- i.e Using the Pay and Park System, instead of parking anywhere

If all of us believe and positively "Maintain" our city, we would definitely achieve our target of making out cities "Smart" at the earliest.

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Early History of Geological Formation & Topography of Gujarat

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Introduction

This research article is based on the study and analysis of early history of geological formation and topography of Gujarat. In the history of Gujarat, there is a clear impression of the geographical environment of that territory on human life in any given territory. Its geological structure of the region has also contributed to the development of the geographical environment. Hence in geographical study, its geological formation is also considered. Different types of rocks lying on the top surface of earth crust and the study of rock layers have been covered in the study of geological formation. Important things like topography and design of land formation, formation of land, structure and its types depends on the topography of particular territory.

Geological History of Gujarat

Gujarat is referred as totally new territory in geological terms. However the geological history of Gujarat is very old and lengthy. Gujarat has experienced many geographical movements during the period from Archean Era to Modern Era. In Gujarat, starting with the oldest rocks of Archean Era there are the territory holding the alluvial rocks of modern era. Altogether 17 geological subdivisions of the world are considered as normal, only 8 geological sections of them are found in Gujarat, the rest is totally lacking. Geological formations found all over the Gujarat are arranged according to their rank and time-age in table - A. From these 8 geological sections many of the geological sections are not found in perfect condition. Some little piece of their regions

appears in sporadically territory. It is incomplete because of some major empty bight coming in the geological history of Gujarat. Thus many sections of "Peliyozoic Era" and "Mesozoic Era" are not found in Gujarat. While the levels of "Pre-Cambrian" and "Turtiary Era" is found relatively.

TABLE - A

No.	Geological Era	Period	Years Ago	Covered Area (k.m.2)	Percentage of Total Area
1	Quaternary Fourth Bio Era	Modern Pleistocene	25,000 10 Lakh	-	-
2	Tertiary Third Bio Era	Paleocene Miocene Oligocene Eocene	1.5 Crore 3.5 Crore 5.0 Crore 7.0 Crore	1,01,743	51.90 %
3	Mesozoic Second Bio Era	Cretaceous Jurassic Triassic	12.0 Crore 15.0Crore 19.0 Crore	68,092 6,636 -	34.70 % 3.40 % -
4	Paleozoic First Bio Era	Permian Carboniferous Devonian Silurian Ordovician Cambrian	22.0 Crore 28.0 Crore 32.0 Crore 35.0 Crore 40.0 Crore 50.0 Crore	-	-
5	Pre-Cambrian Pre - Bio Era	- - -	60.0 to 300.0 Crore	19,553	10.00 %

Source : Geological Survey of India, Gujarat State.

Geological Formation of Gujarat

Igneous rocks formed by Basaltic Lava known as "Deccan Trap" lying in the wider area of Gujarat as a geological formation. Granite and Nice Rocks are found in some parts of the Panchmahal and Bharuch District. With the exception of ground of Ganga-Satlaj of North India and North Gujarat territory, the structure of entire Gujarat has been formed by lava coming out of volcanic blasts and spread over the surface. "Deccan Trap" is found in most areas of Kutch, Middle and South Saurashtra and territory of Gujarat situated at South of Narmada River. In modern times, the Ground of South Gujarat and valley region of Tapi River have been formed due to alluvium clay separated from worn-out Lava rock. Black cotton soil has been formed due to spreading of alluvium by the rivers of south Gujarat, and then the ground of North Gujarat

just like as ground of Ganga-Satlaj has been formed due to spreading of alluvium by Banas, Sarasvati and Rupen rivers.

The stone of Pre-Cambrian or ArcheanEra are found in 19,553 km2 of Gujarat approximately i.e. in 10% region of total area. In which igneous rocks like Granite, Nis and Shist and deformed rocks formed before starting of 60 crores years to 2 billion years have been found. The oldest deformed "Nis rocks" of Archean Era are found in Chhota-udaipur, Bodeli and eastern region of Sankheda. In these rocks there are various types of mixed "Nis Rock". Most of them originated from igneous rocks. Granite and Pegmatite can be attributed in these ancient rocks.

Geological Formation of Gujarat in Pre –Cambrian Era

Geological formations of "Pre-CambrianEra " are very important in terms of mineral resources. Manganese mines of Shivrajpur and Green Marble mines of Motipura are lying in geological formation of this time. Important minerals like Crystal limestone, Dolomite, Graphite, Feldspar are found in geological formation of Vadodara district. There are mines of Lead, Zinc and Marble situated near Ambaji in Danta Taluka of Banaskantha district. Crystal limestone rocks are found from the region of Divaniya and Pasuval situated near Amirgadh.

The geological formations of first Bio Era or Paleozoic era are not found in Gujarat. While Jurassic of Mesozoic Era and geological formation of Cretaceous are found in 6,636 km^2.& 68,092km^2. area respectively. That means the layers of Jurassic times lying in 3.4% region of Gujarat and the layers of Cretaceous times lying in 34.7% region of Gujarat. It is believed that in Mesozoic era approximately 15 million years ago larger area of Gujarat wassunk under the sea water. The rock layers of this time are formed due to deposition of rock materials which are separated from corrosion and erosion. Main rocks of this Era are "Shail", "Limestone", "Rocks of Coral", "Sandstone" and "Conglomerates" which are found from Gujarat.

Jurassic Layer of Kutch

The oldest layer of Kutch and Saurashtra is of Jurassic time. Mainly Jurassic layers are composed of under the sea water. The layers of this time are found in Kutch, so it is believed that ocean of Tithi was expanded till Western Madagaskar. The layers of Jurassic time are found from the surface of Kutch. These layers are categorized in "Pachham", "Chari", "Katrol" and "Umiya" layers which are derived from fossils in kutchh. Jurassic layers of Gujarat are scattered in large region, and has a thickness of more than 2000 meters. The layers of this time are found in highlands of Kutch and Dhrangadhra of Saurashtra. Lower Jurassic rocks are mainly limestone which is composed of shellfish and Corals. While upper Jurassic rocks consists of sand stone, shail and Conglomerates. The Jurassic time layers are situated near Bhuj in Kutch and near Umiya and in Paccham and other islands of big desert and in Rajkot of Saurashtra and Dhrangadhra andWadhvan of Surendranagar district. Limestone, Bauxite, Porcelain soil and Betoniet are found in Kutch from this time rocks. While Silica sand and Porcelain soil are found from the district of Rajkot and Surendranagar.

Upliftment of Costal Layer

Towards the end of the Jurassic period coastal regions are lifted in upward direction and conglomeratessediment in coastal oceans. Thereafter due to increase in the sea level, ocean water moved on land territories. In cretaceous time, i.e. 12 million years ago ocean of Tithi had moved in Kutch, Saurashtra and in the valley of Narmada. The history of this Era has been maintained in the layers of sand stone known as "Nimar" and "Ahmadnagar" and in the layers of "Bagh" and "Lameta". In cretaceous time, ocean water entered into river valley region and coastal land moved towards downward direction. Hence the layers of cretaceous time are found in narrow strip of coast as well as Narmada River's valley. Sand stones of cretaceous time are found in Himmatnagar region of Sabarkantha District. Moreover, sand stone, shale, Conglomerates are found in Dhangadhra region of Surendranagar District as well as in Songir of Vadodara district. Layers known as "Nimar Sandstone" are found under the "Deccan Trap" in southeast region of Pavagadh Hill. Nimar sand stone found from every layers. In some places Lameta layers are situated under the "Deccan Trap" Volcano. The geological formations of cretaceous time are lying in Kutch, Zabva, Alirajpur, Chhota-Udaipur and valley region of Narmada. Thickness of these layers is only 18 to 21 meters.

Geological Formation during Tertiary Era

In Tertiary Era which comes after Mesozoic Era, ocean attacked once again on western region of Gujarat. The mark of this attack is seen in the layers of limestone and clay developed in ocean. In which number of oysters of ocean are seen. The thickness of these layers is 30 meter. Above these layers there are layers of sand, gravel and clay whose thickness is 1219 meter. The carnelian of Ratanpur found from the valley of these layers. The attack of ocean occurred in the region of coastal area. So the oyster layers are seen in Surat and Bharuch district as well as both sides of Gulf of Khambhat. Crude oil fields of Gujarat have been found in these layers. These layers are considered since Miocene times. The oldest layers of Tertiary Era are lying in estuary of Narmada and Tapi rivers of Eocene times. These layers are separated by the Kim River's sediments. These Eocene layers are composed of soil which is separated from abrasion of volcano rocks, gravel, sandstone and limestone. The layers of this time are found at Bodhan situated near Surat. In Kutch, the layers of this time are designed on "Deccan Trap". This ejaculated rocks designed in Eocene time specially found from Surat, Bhavnagar and Kutch district. The main minerals like Bentonite, limestone, gypsum and lignite are found from the rocks of Eosin time. The Eocene time's layers having thickness of 1000 to 1500 meter are designed from Gravel, Conglomerates, sandy soil and limestone. These layers are compared with Gagaj layers of Lower Miocene time. The geological formations of Tertiary Era lying in Kutch district are of Eocene, Oligocene and Miocene time. The geological formations of Eosin and Miocene time lying in Gujarat's coastal regions are covered with coastal alluvial. The layers of Miocene time found in Kutch district are known as "Nari" and "Gajstaro". Large number of limestone rock is found from those layers. "Nari" and "Gaj" layers are found in some regions of Abdasa, Nakhtrana, Mandvi and LakhpatTaluka of Kutch district and in Saurashtra, KalyanpurTaluka

of Jamnagar district and GhoghaTaluka of Bhavnagar district.

Conclusion

There are many spectacular changes Geologicallyin the History of Gujarat. The present Condition of Geographical Formation and Environment of Gujarat is the result of millions of years process. The Geological Formation of Gujarat was the major factor for the development of Political, Social and Economic History of Gujarat. This research article is an attempt to find out the history of Geological Formations in Gujarat. It is not only an article, but also a small study of geological factor of the Gujarat state. Geological formation is a part of Geography. In the historical perspective, the geography of Gujarat is an important platformof NaturalHistory of Gujarat. Ithas also contributed and constructed the Human History in Gujarat.

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Dr. Ambedkar's Philosophy on the Labour Policy

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Abstract:

This paper is regarding work of Bharatratna Dr. B.R. Ambedkar- one of the most respectful crusaders of societal development in India. He is a scholar, a learned jurist, outstanding states man, fighter for human rights, eminent economist, and an activist for the basic rights of depressed class of society, last but not the least he was an architect of the Indian Constitution. By his efforts the interest of labour and working class were promoted. He had significant impact on the labour movement and provided setting up of the Indian labour conference and standing labour committee, enactment of labour laws, establishment of the chief labour commissioner's organization, appointment of legislative committee, machinery for fixing minimum wages, standing orders for industrial development, recognition of trade union, minimum wages Act& social security measures. In the various capacities, he not only suggested but also attempted to implement the labour reforms. As a prominent economist and a crusader for the equitable social justice, he always thought about the agriculture labour problems wherein he suggested the integrated transfer the surplus labour from the agriculture to industry which is the only remedy for the development of the country. He believed that it is the surest remedy, which can help in lessening of pressure on the land, and increasing the amount of capital goods would forcibly create the economic

necessity of enlarging the land holdings. He believed in the intersectoral transfer of labour from agriculture to industry. Paper derived that Dr.Ambedkar was a visionary and had foreseen the future of the Indian economy before almost seventy years and accordingly made relevant suggestions regarding the labour policy and land reforms. Following his thinking it should be possible for our country, to march towards the economic reform with a human face.

Introduction:

This paper is tribute to the Bharatratna Dr. B.R. Ambedkar- one of the most respectful person of India: a scholar, a learned jurist, outstanding states man, fighter for human rights, eminent economist, a crusader for the basic rights of depressed class of society and last but not the least an architect of the Indian Constitution.

Being an outstanding personality in the branch of economics, Dr. Ambedkar visualized economic plan for free India nearly a century ago and defined it, which is also relevant in the prevailing time. He defined the economic plan as,

"Ultimate object of all planning must be raising the standard of living of the people as a whole and to ensure employment for all. To that end the purchasing power of the people must be increased by improving efficiency and productivity of labour on the one hand and simultaneously development and reorganization of the agriculture, industries and services on the other"

It is pertinent to note that Dr. Ambedkar thought of the problems of Indian industrial labour, Agriculture labour& industrialization, Migration of farm labour to the industry and lastly Land reforms. He suggested and even formed drafts of various laws regarding these issues and even enacted them in his time when he was authority under various capacities. His ideology regarding industrialization, labour policy and land reform is very relevant even today.

To understand the same we must study his multipronged approach to economic planning for the upliftment of labour and there by Indian society and nation.

Dr Ambedkar's Vision for Labour Policy:

Dr. Ambedkar was in favour of keeping labour in the concurrent list of our constitution, so that their interests are adequately served by the uniformity of legislation throughout the union and to ensure uniformity with international regulations.

By his efforts the interest of labour and working class were promoted. He had significant impact on the labour movement and provided setting up of the Indian labour conference and standing labour committee, enactment of labour laws, establishment of the chief labour commissioner s organization, appointment of legislative committee, machinery for fixing minimum wages, standing orders for industrial development, recognition of trade union, minimum wages Act& social security measures. In the various capacities he not only suggested but also attempted to implement the labour reforms.

Labour Law Reforms:

As a labour member in the third meeting of the Tripartite Labour conference on 7th May 1943 emphasized on the joint consultation of the representative of the employers and employees. He also equally emphasized on the food, clothing, shelter, education, amenities, and health resources to be provided to workers. A resolution was also adopted to set up the machinery, which will investigate the question of wages and earning in the said conference.

As a member of legislative council, labour movement during the year 1928 in Bombay was supported by him. He also emphasized protection of the interests of women worker. He suggested about the maternity benefit of women labour and recommended that the mother ought to get a certain amount of rest during prenatal period and such burden ought to be borne by the government.

During his tenure as a labour member, he amended the factories Act for three times. In 1944 the bill for the holidays for industrial worker was moved, which was enacted on 3rd April 1945.The Act allowed workers to avail compensatory leave if weekly off remained unutilized.

The amended Act provided 10 days paid leave to adult and 14 days leave to child. Another amendment was adopted on 4.4.1946 restricted the daily and weekly working hours for workers. He proposed for adult workers 9 hrs and 48 hours in perennial factories and 10 and 50 hrs in the seasonal factories. He also suggested that if the laborer works more than this, overtime is to be paid and overtime should be double the normal rate. Dr. Ambedkar justified that the Industrial worker worked for longer hrs during the Wartime and needs relief.

Dr. Ambedkar twice amended the Indian Mines Act. In 1945 through an ordinance rules which were made by the government to maintain crèches for the children of those establishments where women workers are employed. Again in february1946, he suggested to keep adequate separate bathing place for men and women workers which are hygienic.

Regarding Industrial Employment Standing Orders Act, 1946, he proposed that the Act should not only in paper to implement for the terms and conditions for the employment but they should actually be implemented. Terms and conditions of employment should be certified by the competent officer meant for this purpose. The register should be maintained for the same. Dr. Ambedkar introduced a bill-The Industrial employment (standing orders) bill in Central Assembly and the same was passed in 13.4.46.

Present Labour Laws and Dr. Ambedkar's Vision

Presently under the Industrial Dispute Act, 1947, the works committee in the factories employing 100 or more workers is compulsory. The composition of works committees are the bipartite consisting of equal number of the workers representatives and employers representatives. Dr. Ambedkar afforded for the enlistment of labour, the main function of the committee is to secure and preserving the interest of workers by promoting and maintaining good industrial relations. Similarly under Bombay industrial Relations Act, 1946 formation of various committees like Joint Management Council and Joint committees are mandatory to protect the

interest of worker. Violation of the above provision leads organization towards the penalization.

The maternity benefit Act enacted in the year, 1961 is to protect the dignity of motherhood and the dignity of the new baby's birth by providing for the full and healthy maintenance of the workman and her child at the important time when she is not working. Under the provisions of this Act, all the women either employed directly or through contractor, domestic women employees employed in mines factories, plantations and allow in the other establishments are entitled to get benefit of cash and non-cash benefits including leave for maternity. Leave for the miscarriage and tubectomy operation under section 9&13 of the Act is included as the additional benefits. The violation of the Act leads to the imprisonment which may extend upto one year or fine or both.

Dr. Ambedkar's vision was very clear. What he thought was reflected in the amended Factories Act of 1948, where in the Daily hrs and weekly hrs of the work are fixed as 8 and 48 respectively, which are also prevailing in the seasonal industries also. His suggestion of the overtime payment is also prevailing as under the Factories act 1948.The overtime is to be paid to the workers in factory is twice than the normal wages if they work more hours than the prescribe.

Presently as per the Indian Mines Act, 1952, section 46 refers that woman employees are prohibited for underground work and allowed to work above the ground between 6 am to 7 pm. Also as per the sec19,29,21 the provision for the separate latrine and urinals to be provided in proportion to the number of male and female employed in the in and provide for such other matters in respect of sanitation in mines. So, the suggestions of Dr. Ambedkar were very relevant in the prevailing era.

As per industrial standing orders Act, 1946 there is the provision to certify standing orders within 60days from the date of the actual functioning of the undertaking. The standing orders are to be certified by the commissioner of labour who certifies it after the due verification, amendment, confirming or altering the standing order in order to convey it in the written terms and conditions of the services of the employees. As per the provision of the Industrial employment standing order Act 1946, the said standing orders are to be placed at the place where the majority of the workers take entry in the organization.

Dr. Ambedkar views on the strike and the right to strike are very educative for the development of trade unionism in India. He decided to set up the standing labour committee on 7/5/43 and also labour conference was organized. It was decided to setup the standing labour management committee at least in the factory units. He emphasized to established employment exchanges so that safeguard of skilled and unskilled labour can be protected. He tried to formulate full employment policy for labour; a state supported and patronized labour welfare system to form a tripartite labour tribunal system to solve industrial disputes, to develop an idealist labour participatory mechanism in nation building. Dr. Ambedkar throughout his life argued for evolving state patronized and supported labour welfare system for our country. He opined that the government should directly intervene in the areas where the labour interests are involved. He

always conceptually tried to advocate the need for linking wage determination to productivity and minimum needs of the labour. He always advocated for the labour tribunals for soiling labour problems in the organized sector, He felt that the management, labour and government should sit across the table to discuss, explain and explore the issues of labour unrest and find out the solution for the labour problems.

This shows that ideology of Dr. Ambedkar was very relevant in the prevailing era, as the compulsory enactment of the labour laws is mandatory. Regarding performance based salary the nowadays organizations are very keen about that and emphasized on the productivity based wages. Even Government of India rethinking the raising the salary considering the criterion of productivity and efficiency.

Land Reforms & Transfer of Surplus Labour

Dr. Ambedkar, a prominent economist and a crusader for the equitable social justice, always thought about the agriculture labour problems wherein he suggested the integrated transfer the surplus labour from the agriculture to industry which is the only remedy for the development of the country.

He believed that it is the surest remedy, which can help in lessening of pressure on the land, and increasing the amount of capital goods would forcibly create the economic necessity of enlarging the land holdings. He believed in the intersectoral transfer of labour from agriculture to industry.

According to Dr. Ambedkar, an idle labour is the calamity and instead of contributing to the national income, it consumes the meager surplus, which in turn prevents capital formation. Even if more capital and capital goods, there will be increase in the idle labour on the given size of the farm as more capital and capital goods does not require much of labour force. He also felt that it is not the law of inheritance that was the evil, but high pressure on the land makes the situation worst.

He advocated the transfer of labour from agriculture to industry by considering the industrialization as soundest remedy for the agriculture problems of India. This moment is the best narrate his quote from the *London times* prove his suggestions.

> *"The value of farm lands decreases in exact proportion as the ratio of agriculture to other industries increases, that is where all the labour is devoted to agriculture, the land is worth less than where only half of the people are the farm workers and when only a quarter of them are so engaged the farms and their products are still more valuable. Manufacturer and varied industries thus not only benefit the manufacturer, but are of equal benefit and advantage to the farmers as well"*

He preferred fast industrialization for the reasons that industrialization facilitates consolidation of land, lessen the premium of land. It is a barrier against future subdivision and consolidation. The surplus labour of the agriculture itself can be accommodated in industries and so problems

of unemployment can also be solved. For the landless labour he emphasized for the collective farming which could have been the responsibility of the state government. State should be the owner of the land and land is required to be redistributed among the people. So no landless people are there. Though it has been declared policy of the government of India that the Land reform should be recognized to constitute a vital element both in terms of the anti poverty strategy and for modernization and increased productivity in agriculture, very little achievement is made in this regard. Thus Dr. Ambedkar preferred industrialization for many reasons as referred above. His views on industrialization for an emerging country have constituted the core of the norms for the formulation of Industrial Policy resolution 1956 of free India. Maximization of output efficiency and productivity was the major concern of Dr. Ambedkar in his time for the industrialization. For him the agriculture was to be state industry. He recommended that the state should acquire also with the key and basic industries and insurance. He suggested that all the agricultural land held by private individuals, whether as owner or tenants should be mortgaged and pay them compensation equal to the value of the land. Further the state should divide the land acquired into farms of the standard size and should let out the farms for cultivation to the residents of the village as tenants.

Realising of Ambedkar's Vision -Special Economic Zone

Government of India had introduced SEZ (special economic Zone) policy for the land reforms and liberalization. SEZ is defined as „delineated duty free enclaves and are deemed foreign territories for the purposes of trade operations, duties and tariffs .A SEZ may be set up in the public private or joint sector or by the government, subject to the compliance with the policy and guidelines issued by the Ministry of Commerce. The policy requires the minimum size of the SEZ to be 1000hectors.To contribute into the country's GDP and creating large employment opportunities land areas suitable for certain projects to be identified and decided. The big industrial projects will acquire the large chunks of land which further contribute the industrialization of the country and development of the land. Due to this, the price of the capital land and human capital will be high.

Unfortunately , Dr. Ambedkar's suggestion for the land reform as" State socialism" was not accepted at the relevant time, for both the development of the smallholding of agrarian land as well as for the development of the industrialization. Now after so long through SEZ, government of India had tried to acquire the land and for its development allot it to the large industrial houses.

SEZ in turn had to create large employment opportunities. The owner of the small holding will be encouraged to sell their land which is small and non productive and in turn the industry will give handsome compensation with the employment opportunity. Ultimately the complete process will result into the productivity of involved individual's development of industry and optimum utilization of land used.

The survey carried out by the National Sample Survey Organization in 2012-13, showed that for 56% of the marginal land owning family's (with land less than 0.01 hectare) employment

is agriculture, and that was their principal source of income. Another 23% reported livestock as their principal source of income. Also survey says that large no. of the workers in unorganized sector is occupied by the agriculture workers. If government of India wished by its future developmental policies of the Indian economy, can divert the major portion of the unorganized labour to the organized sector.

Conclusion:

It can be derived from the above discussion that Dr.Ambedkar was a visionary and had foreseen the future of the Indian economy before almost seventy years and accordingly made relevant suggestions regarding the labour policy and land reforms. Following his thinking it should be possible for our country, to march towards the economic reform with a human face.

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Original Paper

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CRISPR : An Overview

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Absract

Since 2012, CRISPR molecule has been found to be fast, easy & cheap method of tinkering with genetic code of plant, animal and human beings.The technique can be used by any good laboratory to treat human diseases and generate designer babies which might actually lead to a generation of super-humans. It's no wonder that the technology is highly debated but is undoubtedly a doorstep of genetic revolution.

What is it?

CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeat. They were first discovered in most primitive life forms known to us – bacteria.

Bacteria, in order to fight infection of virus, has unique organization of short, partially palindromic repeated DNA sequences in genome.If viral infection threatens bacteria, this naturally evolved immune system of repeated sequence and spacer destroys genome of invading virus and there by protects bacteria from viral infection.

How does it work?

Along with CRISPR sequence, there is also a set of genes that code for enzymes that can cut spacer DNA sequence (spacer DNA sequence occurs between two repeats and is generally derived from invaded virus) which are referred to as cas or crisper associated sequence. Together CRISPR-Cas sequence of bacterial DNA precisely cuts genome at specific places and prevent

their propagation.

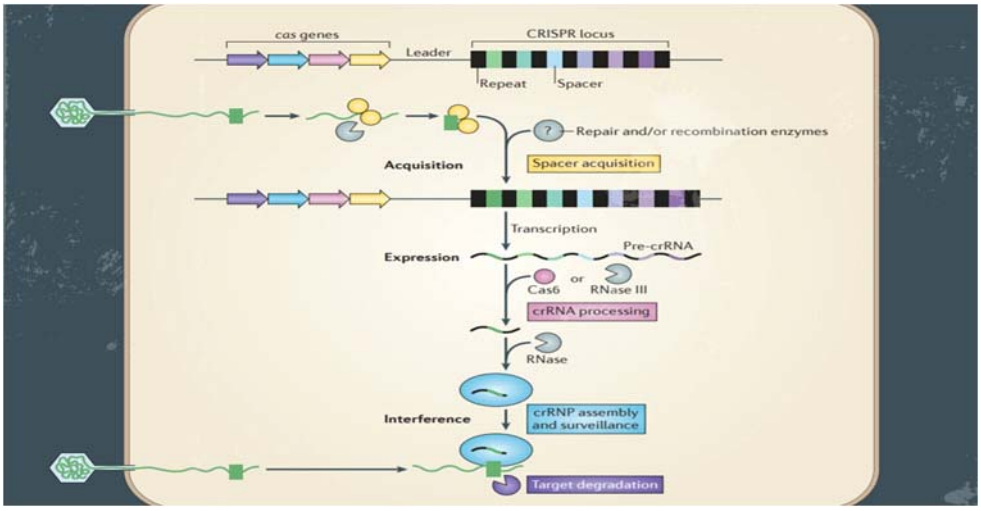
Scientists and Researchers have now developed tools to engineer this bacterial immune machinery to cut and insert any desired DNA sequence in higher organisms including humans.

In a way, this cutting edge genome editing is similar to proof reader in printing press. That is, this technique can be used to modify sequence so as to correct faulty genes.

Technicalities

In order to use CRISPR-Cas system in nonbacterial cells just two components are required: a Cas enzyme to snip target DNA—for example, inside a gene of interest—and an RNA molecule, called guide RNA (gRNA), which binds the target through complementarity. The gRNA is a shorter version of the CRISPR RNA made in bacterial cells. It forms a complex with Cas and directs the enzyme to the correct cleavage location. The DNA break usually causes mutations that inactivate the gene.

But researchers can also wield the tool for gene correction and gene regulation by mixing in additional components or tweaking the activity of Cas.



A schematic diagram to explain working of CRISPR -(Origene Calendar, Nature Reviews)

Salient features

- Zinc finger nucleases (ZFN)&Transcriptional activator-like effector nuclease (TALENS) currently practiced alternative to CRISPR are less accurate, costly and time intensive as they are based on trial and error method to edit specific gene
- CRISPR is much faster at producing genetically modified mice. Genetically modified mice are most common model to study human disease. Generally traditional breeding method is used which is very time consuming and tedious.
- CRISPR can be used to modify multiple genes at once. This is useful for studying diseases which involve more than one gene.

Application

- *In industry* – CRISPR based immunity can be employed to make these cultures more resistant to viral attack , which would otherwise impede productivity and can thus improve sustainability and lifespan.
- *In laboratory* – researchers have learned how to exploit CRISPR technique to make precise changes in genes of diverse organisms like fruit flies, fish, mice, plants and even human cells. Specific change in one gene allows scientist to understand association between a given gene and it's consequence to the organism.
- *In medicine* – one application is for treatment of genetic diseases. It can also be used for infectious diseases by making specific antibiotics which affect only disease causing bacteria and leave healthy bacteria unaffected.

Ethical Issue

Scientists in China reportedly carried out first experiment using CRISPR to alter DNA of human embryos. Scientists in London have been granted permission to edit genome of human embryo for research by UK Human Fertilization and Embryology Authority (HFEA).

These events rang ethical alarm bells, not only from NGOs but also from prominent scientists and experts in bioethics becausedata as of now does not guarantee safety and fear of unknown consequences is always there.

This technique may also be used by parents to create smarter, taller, stronger kids which would result in generation of super humans.

One one side CRISPR can aid in treatment of heritable genetic disease however it might also create unwarranted changes in germ cells which would be then introduced in human population.

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Book Review

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Book	BECOMING STEVE JOBSThe Evolution of a Reckless Upstart into a Visionary Leader
Authors	Brent Schlender and Rick Tetzeli
Genre	Biography
Place	Great Britain/ India
Publishers	Sceptre/ Hachette
Date of Publication	24th March, 2015
Pages	447pp.; Illustrated
Price	£25/ ¹ 699
ISBN	978-1-4447-6198-6
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"I didn't want to be a businessman, because all the businessmen I knew I didn't want to be like." This is what Steven Paul Jobs often told Brent Schlender – one the authors of Becoming Steve Jobs – despite being a hugely successful businessman. The young Steve Jobs was a mess of contradictions, write Schlender and Tetzeli. He was a co-founder of one of the most successful

start-ups ever, but he didn't want to be seen as a businessmen. He craved the advice of mentors, and yet resented those in power. He dropped acid, walked barefoot wore scraggly jeans, and liked the idea of living in a commune, yet he also loved nothing more than speeding down the highway in a finely crafted German sports car. He was impatient and intransigent and aggressively rude, but he was eager to learn and eventually would apologise if in the wrong (more often than not); a practicing Buddhist who was also an unrepentant capitalist and wanted to bring sophisticated and quality technology to people's homes.

Although his life could be and already has been made into several movies, the authors believe it is much more than that. Veteran journalists Brent Schlender and Rick Tetzeli present a portrait of Jobs that is far more nuanced and intimate than previous biographies as the ups and downs that Jobs had in his personal and professional life are well documented in this book through interviews with Jobs' family and friends and the authors' writings over the decades. Brent Schlender, one of the premiere chroniclers of the personal computer revolution, covered Steve Jobs for the Wall Street Journal and Fortune for nearly 25 years and Rick Tetzeli has covered technology for two decades and has been closely involved with Schlender's work. However, this is largely a first person account from the perspective of Schlender since he came close to the innovator through his reportage. 'Becoming Steve Jobs: The Evolution of a Reckless Upstart into a Visionary Leader' works brilliantly to overturn the popular and conventional view of Steve Jobs, that of being half genius and half jerk. It answers a compelling question about the Apple co-founder and CEO, how did a young man, who was so reckless and arrogant that he was exiled from the very company he created, become one of the most effective visionary business leaders of our time?

Schlender and Tetzeli paint pictures with words in their work and give us a glimpse into the life of the legendary creator, innovative designer, marketing expert and exasperating perfectionist. What else would you call the man who believed in and stood by his credo – Simplicity is the ultimate sophistication – shared by the company we know as Apple! The authors take us through an eventful and exciting journey of Jobs' life from when he was the public face of the personal computer industry despite still being a kid at twenty-four years old to his last days as he was battling with cancer and ensuring his legacy at Apple of good design and ingenuity lived on.

There are several previously untold accounts of Jobs' life and work and through these anecdotes, the authors have managed to do what a lot of the other biographies have missed and that is create a much more layered portrait of the man whose mind could clearly see what was not there, what could be there, what had to be there; a mind which was never a captive of reality! Nonetheless, there also are numerous accounts that find place here which one can also read through Isaacson's work (has the distinction of being the authorised biography) and watch in movies where Ashton Kutcher (Jobs, 2013) and Michael Fassbender (Steve Jobs, 2015) among others have reprised Job's *enfant terrible* roles with much finesse. In fact several incidents in his life have been recounted here – like his rejection

to accept Lisa as his daughter, as well as his failed and extravagant comeback among others – which paint him in poor light.

However, what this book celebrates in chapter after chapter are the redeemable qualities of the man behind the rash and brash dictator. Whether it is in the very first chapter where the authors tell us of his impatience with the lack of efficiency of an NGO he was involved in and how he breaks down after his rant or towards the end where colleagues speak up about how he inspired them and stood by them as a fast friend, the biography time and again focuses on the positives. There are several interesting and endearing anecdotes about the genius madman who ended up making friends out of people who weathered his moods and understood the idea within. One such episode highlighted by the authors is that of the earliest (and for a long time possibly the only) retailer, Ron Johnson who was responsible for the Apple stores' design and merchandising. Despite several struggles with the designing of the prototype, Johnson always received the necessary push from Jobs to be creative and audacious and strive for the best. He deemed Jobs to the best delegator he ever met! Johnson said at a Stanford address, "He was so clear about what he wanted that it gave you great freedom."

The book also gives you insight into his marketing prowess. The authors note how Jobs embraced the marketing adage that every single moment a consumer encounters a brand – whether as a buyer, a user, a store visitor, a passerby seeing a billboard, or someone simply watching an ad on TV – is an experience that adds either credits or debits to the brand's 'account'. His emphasis on design finds place in the writing too when his ideas on good design are quoted as 1. innovative 2. what makes a product useful 3. aesthetic 4. what makes a product understandable 5. Unobtrusive 6. honest 7. long-lasting 8. thorough down to the last detail 9. environmentally friendly 10. as little design as possible.

The chapters progress to show how caring Jobs was and of his concern for employees and colleagues. He took a personal interest in their wellbeing and an episode that brings a smile to one's lips is how he managed to call up Tim Cook's mother to ask about his lack of personal life! Another incident which touches the heart is how honest he was in his dealings with Bob Iger during the Pixar-Disney deal revealing that his cancer had recurred before the press conference. The Pixar adventure finds its own chapters (A Side Bet and Luck) where Jobs' purchase of the animation studio is highlighted through several interviews done in the past by Schlender. The only one of two historic 'on the record' meetings of Steve Jobs and Bill Gates also has its place in the sixth chapter, Bill Gates Pays a Visit. Wherever necessary, the authors use their own interviews and official annual reports and government statistics to highlight the topsy-turvy ride of Apple and NeXT and their eventual merger as well as the action-packed journey of Apple Inc. and its products from iPod to iPad.

And all through the book, you see how Jobs matures and become the visionary leader that we fondly remember him as. He is inspirational and a true leader and whether it is through

his Stanford address or his leading by example and living the life he lived, Jobs packed a powerful message for all of us when he spoke about how he didn't really care about the consequences because that is what he wanted to do, and if he tried his best and failed, well, he tried his best! He also asked some pertinent questions... "What's the truth of your ambition? Do you have the humility to continually grow, to learn from your failures and get back up? Are you utterly relentless for your cause, ferocious for your cause? Can you channel your intensity and intelligence and energy and talents and gifts and ideas outward into something that is bigger and more impactful than you are? That's what great leadership is about. But of all the sum total of life lessons we can learn from him, the most important one is, according to me, "Your time is limited, so don't waste it living someone else's life."

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Guidelines for Contributors

- The journal of Gujarat University, 'Vidya' welcomes original research papers, scholarly articles and book reviews, abstracts of theses accepted by the University and texts of invited lectures from the faculty and research students of Gujarat University, its affiliated colleges, post graduate departments/centers and recognized institutions.
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- Format: All the manuscript must be either submitted in PDF and Word Document. The manuscript with formulas must be submitted in LaTex format. All figures must be in JPEG/GIFF only. The Tables must be prepared in excel or must be drawn in Word Document. Image format Tables are not acceptable.
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The Abstract must not exceed 300 The Abstract should serve both as a general introduction to the topic and as a brief, non-technical summary of the main results and their implications. Abstracts must not contain references or subheadings. Abstract must be free from citations.

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- Results: Results must be appropriate to the conducted research experiments. Results of the individual experiments must be elaborated under appropriate subheadings. All the figures and tables provided must be labeled accordingly in the order of sequence they follow.
- Discussion: The Discussion section must be succinct and usually do not contain subheadings.
- References: Please look at the formatting corner for appropriate guidelines in preparing references.
- Acknowledgements: Acknowledgements should be concise, and should not include thanks to anonymous referees and editors, or extraverted comments. Grant Numbers and the Grant details must be acknowledged if any.
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