2013

CLEAN TECHNOLOGY DIVISION

The Scheme on

'DEVELOPMENT AND

PROMOTION OF CLEAN

TECHNOLOGY

AND

WASTE MINIMISATION

STRATEGIES'

IMPORTANT ACTIVITIES UNDERTAKEN BY THE CLEAN TECHNOLOGY DIVISION

(a) Demonstration projects for Development of Cleaner Technologies: In order to facilitate access to clean technology and its adoption by the small and medium scale industries, in identified industrial activities in need of switch over to cleaner technologies and waste management strategies, assistance in the form of grant in aid would be provided to autonomous institutions/statutory bodies under Central and State Government in the field of R&D/Extension or registered companies having healthy financial record, with inhouse R&D units, preferably recognized by DSIR, and having tie up/ collaboration with industries/consortium for setting up pilot/demonstration projects for new technology/up-gradation of available technology, in such industrial clusters, 24 industrial sectors have been idetified by the Ministry.

The proposals are invited through open advertisement in the importal daily news papers. Format of the proposal is available in the guidelines. The support from the Ministry would primarily cover prototype development, cost of pilot plant, cost of process equipment development, test and evaluation of products, user trials, running cost (raw materials, consumables, hardware/ software tools, components/sub-assemblies for prototype, equipment for pilot plant etc.), contingencies, travels and salaries for the consultants and supporting staff etc. This does not include the cost of the land and building, which shall be provided by the project proponent/industry. The scale of assistance would be limited to 75% of the project cost, excluding land and building.

(b) Life Cycle Assessment: Life Cycle Assessment Studies in Thermal Power Plants, Steel, Pulp and Paper, Cement and Construction Studies has been completed while wood and Bamboo Composite Products are likely to be completed.

(c) Carrying Capacity Studies: Carrying capacity studies of Greater Kochi Region, Doon Valley, Damodar River Basin, Tapi Estuary and National Capital Region (NCR), Natural Resource Accounting Studies for Upper Yamuna Basin; has been completed.

(d) Creation of data base for Clean Technologies: The project on "Data Base on the available cleaner technologies in the country as well as in abroad, Evolving a Networking Mechanism of the Research Institutions of the country, Capacity Building in the financial sector and application of fiscal instruments for adoption of clean technologies by the Small Scale Industries are in progress". Ministry has awarded the project to CPCB with 18 months duration. Unfortunately, it is getting delayed.

(f) Training programmes for Adoption of Clean Technologies etc.: The objectives of the training program is to provide the participants with hands-on training on Cleaner Production (CP) approaches and methodologies; waste minimization techniques; understanding of environmental acts, rules & regulations, understanding basic design, operating features of Pollution Control

devices/technologies; operation & maintenance issues along with possibilities of reducing production costs and improved productivity, case studies of various cleaner production/technologies adopted etc.

(f) Development of Clean Technology Park for showcasing important cleaner technologies: Establishment of a clean technology park is under consideration of this Ministry. This will help to make the industries aware about the cleaner technologies available in the country. It will also help them to understand the environmental as well as economic benefits of the technologies. Model of the Clean Technology Park is yet to be finalized. GIZ has agreed to provide technical assistance for setting up of the Park. Once the model is finalized, the work on the Park would be initiated.

Clean Technology Park would also be a centre for training to the environmental officers/managers. Course material for the training for each sector would be prepared and designed by a group of experts. Accordingly, training will be imparted in the Park itself. Provisions would be made to give certificate for diploma or short term cources to the trainee to make the Clean Technology Park more useful and attaractive.

COMPLETED PROJECTS ON

DEVELOPMENT AND PROMOTION OF CLEAN TECHNOLOGY AND WASTE MINIMISATION AND STRATEGIES

1. Identification, Development and Utilisation of Natural Dyes from the Forests Plants of Uttaranchal by FRI, Dehradun.

2. Up-gradation of Bamboo Mat Corrugated Sheet Technology by Indian Plywood Industries Research & Training Institute, Bangalore and M/s Timpack Private Ltd., Byrnihat, Meghalaya.

3. Utilization of Anode mud and Chips-the solid waste generated in the Zinc Industry, for making value added products, RRL, Bhopal.

4. Bioremediation of Railadevi Lake in Thane District of Maharashtra.

5. Waste Minimisation study bulk drugs units in and around, Hyderabad by APITCO, Hyderabad.

6. Recycling of Marble Slurry Waste for Environmental Improvement in Udaipur by M/s Indian Environmental Society, (IES) Delhi.

7. Waste Minimization and Demonstration Studies in Textile Dyeing Industries in Kolkata by M/s Environ Control & Development Consultants, Kolkata.

8. Life Cycle Assessment for cement and construction Industry – concrete by NCCBM, Haryana

9. Environmental Pollution Control in Agro-based Paper Industry by Implementation of Lignin Precipitation System (LPS) Technology.

10. Implementation of improved up-flow anaerobic sludge blanket (UASB) system, sulphur and energy recovery from tannery wastewater in a cluster at Dindigul, Tamil Nadu.

11. Development & Demonstration of Environmentally Sound Technology for Regenerating/ Recovery/Recycling of Paint Sludge by NPC, New Delhi & Maharani Paints, Faridabad.

12. Pilot demonstration of Clean Technology for landfill gas (LFG) recovery at Okhla site, by TERI, New Delhi.

13. Development of Fly Ash Based Geopolymer Concrete Precast Elements to Annamalai University, Annamalai Nagar, Tamil Nadu.

14. Promotion of Cleaner and Environmentally Friendlier Technology in the Highly Polluting Small – Scale Glass Industry Cluster at Firozabad by M/s Winrock International India, New Delhi.

15. Enhancing the Environmental Performance and Competitiveness of Vegetable Oil Industry in Andhra Pradesh –Waste Minimisation (WM) Assessment, Demonstration of WM Measures and Training.

16. Bio-Adhesive for wood panel industry by Indian Plywood Industries Research & Training Institute, Bangaluru.

17. Design and Development of Computer Numerical Controlled Eco-Friendly Welding Machine by Annamalai University, Annamalai Nagar, Tamil Nadu.

18. Development of Air Pollution Control Package for Small Scale Lime Kilns to National Environment Engineering Research Institute (NEERI), Nagpur.

19. Waste Minimization in Basic Chrome Manufacturing Unit by M/S Ramky Enviro Engineers Ltd., New Delhi.

20. Defluridation of Natural Waters using Eco-Friendly Materials for sustainable Development by Jawaharlal Nehru University (JNU), New Delhi.

21. Production of bioelectricity from sludge and domestic wastewater using Microbial Fuel Cell by Department of Polymer Science & Technology, University of Calcutta.

22. Waste Minimization Studies in Small Scale Industries-Electroplating Sector-in Balanagar Industrial Area, Environment Protection Training Research Institute (EPTRI), Hyderabad.

23. Waste Minimization Studies in Small Scale Industries – Textile Sector in Nandigaon Village Kothur Mahboobnagar Distt., (A.P.).

24. Establishment of Waste Minimisation Circle phase–I and phase–II by NPC, New Delhi.

25. Minimization of Environmental Impacts of Slaughter House Wastes by Value Addition as Pet Foods.

IMPORTANT

COMPLETED

PROJECTS

OF

CLEAN TECHNOLOGY

DIVISION

Recycling of Marble Slurry Waste for environmental improvement in Rajasthan (1)
Indian Environmental Society, Delhi

Brief of the project: *The Society has implemented pilot project on Recycling of Marble Slurry by setting-up a small scale project on Recycling of Marble Slurry at RICCO Industrial Area at Amberi, Udaipur. The aim of the project is to demonstrate the use of slurry as resource and not waste. The Society with the support of Ministry of Environment and Forests, Govt. of India has taken initiative to upgrade the technology and established unit to make bricks from Marble Slurry. The Society developed the technology for recycling of waste and the bricks produced from the slurry have been tested by the Central Building Research Institute, Roorkee. These bricks has been found as an excellent construction material and offer a viable option to replace the traditional bricks. The results of testing have shown that the bricks produced from the Marble Slurry Waste are much better in quality, having more comprehensive strength and less water absorption capacity. The cost of the Marble Slurry is also comparable to the traditional bricks. The Society has also developed the tiles from the slurry and this could be another use of Marble Slurry Waste.*

The Society has provided brick making units to industries two in Kota and one at Rajasmand. These units are given practical training to use the slurry into bricks. The granite slurry is used at Kota for making bricks. The setting-up units at Kota was not in the original project but the request of the Ministry these units were set-up. The Society has organized number of training and awareness programs to popularize the marble slurry bricks. The educational material has been developed under this project and has been widely distributed. The Society has motivated the local Marble Slurry industries to promote and use marble slurry bricks in their construction work. These industries have shown positive interest to adopt and commercialize the technology. The Society undertook the marketing survey to understand the market potential of these bricks. It was analyzed after the Survey that is the State of Rajasthan the market potential with growth potential is 10-15% in future. The Society worked out the marketing strategies after having discussion and survey with architect, masons and building material dealers.

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(3)
Development of Adhesive from Bio-materials: Indian Plywood Industries Research and Training Institute (IPIRTI), Bangalore

Brief of the project: *Lignin and Tannin are two products obtained from tree. Both the products have certain characteristics similar to phenol. These properties of lignin and tannin have been utilized to develop bio adhesives in which phenol has been replaced partly in phenol formaldehyde resin. Bio adhesives thus prepared have been successfully utilized in the manufacture of higher grade plywood.*

Although lignin reacts well with formaldehyde in combination with phenol but the rate of reaction and molecular nature of the resultant polymer differs in physical properties. To achieve consistency in the characteristics of lignin extracted from black liquor, an ultra-filtration process was studied for commercial implementation. In the present investigations, the industrial black liquor obtained from different sources was fractionated by membrane separations and were used in development of phenolic resins by partial replacement of phenol. Tannin is tree bark extract mostly used for converting skin into leather. Tannin contains phenolic unit which react with formaldehyde to polymerize into resin. Mimosa wattle tannin has been used in preparation of tannin formaldehyde resin for making particle board and also plywood. But large scale success in the field of plywood adhesive has not been reported.

Keeping in view the fast curing mechanism of tannin, a low condensed phenol formaldehyde resin was developed and extended with mimosa wattle tannin for the manufacture of plywood. This development yielded a cheaper adhesive and also could bond veneers of higher moisture content which conforms to boiling water proof grade. Use of high moisture content veneers for bonding veneer results in saving energy requirement for drying.

Both the glue formulations have been found to be environment friendly. Since these bio constituent in the glue i.e. lignin and tannin replace phenol in the phenol formaldehyde resins the use of these wood adhesives will reduce use of petro product – phenol whose price fluctuate over the year.

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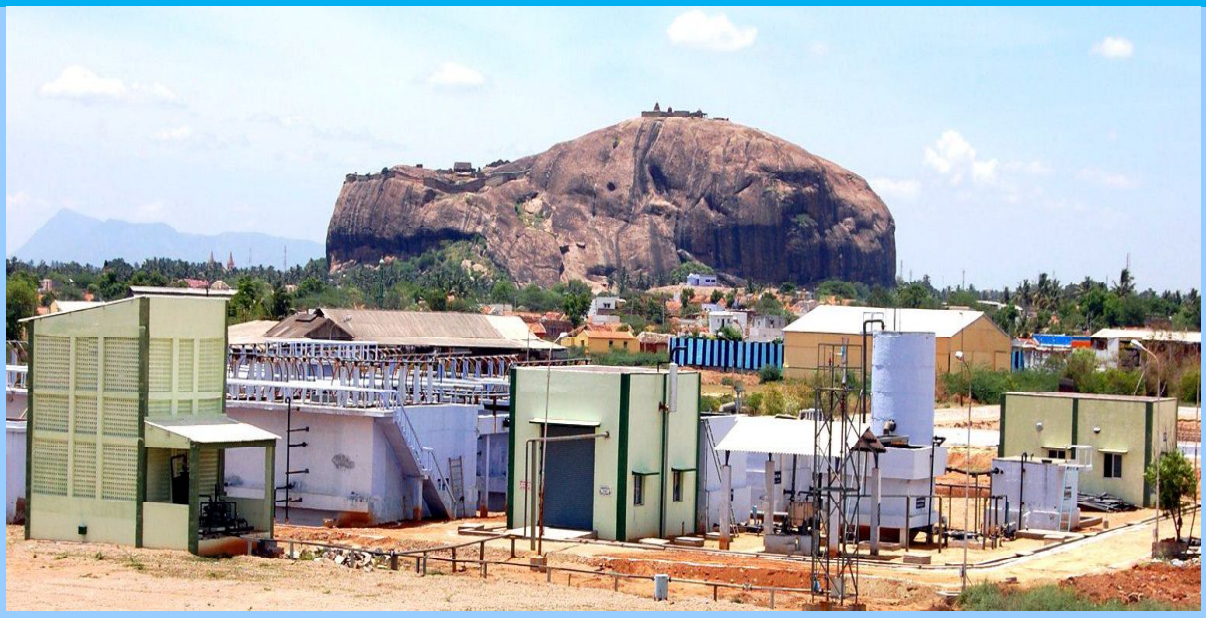
R&D APPLICATION IN TECHNOLOGY UP-GRADATION OF CETP IN TANNERY CLUSTER IN DINDIGUL, TAMIL NADU
CENTRAL LEATHER RESEARCH INSTITUTE (CLRI), CHENNAI.



Brief of the project: *The tanning industry is one of the oldest industries with more than 2000 tanneries in India. Out of this nearly 900 tanneries are located in Tamil Nadu. The tanneries in clusters have established Common Effluent Treatment Plants (CETPs). Out of 18 CETPs in India, 14 are in Tamil Nadu. The cluster of tanneries in Dindigul numbering about 60 established a CETP with a capacity of 2500 m^3/day. The CETP is located in the Dindigul Municipal Town area adjacent to National Highway NH-7 and is built up with conventional treatment systems such as physio-chemical treatment, open anaerobic lagoons and aeration system. The open anaerobic lagoons due to degradation of organic matter in the effluent exit methane and hydrogen sulphide. This caused emission of green house gases and odour in the surrounding area.*

In the Corporate Charter signed between Ministry of Environment & Forests and the Indian tanning Industry, one of the main tasks is to convert the open anaerobic lagoons into closed anaerobic system with biogas generation. With a view to control methane emission, odour and minimize sludge generation, Central Leather Research Institute (CLRI) has developed an improved Up flow Anaerobic Sludge Blanket (UASB) system with sulphur recovery and energy generation at pilot scale. For commercial scale application of these novel systems at Dindigul CETP, the MoEF has approved the project for a total financial outlay of Rs.490 lakhs with a sponsorship of Rs. 213 lakhs by MoEF, Rs. 87 lakhs by MNES, Rs.65 lakhs by CSIR and Rs.125 lakhs by the tanning industry. The CETP Company has also provided land and other facilities.

(5)

DESIGN AND DEVELOPMENT OF COMPUTER NUMERICAL CONTROLLED ECO-FRIENDLY WELDING MACHINE BY ANNAMALAI UNIVERSITY, ANNAMALAI NAGAR, TAMIL NADU.

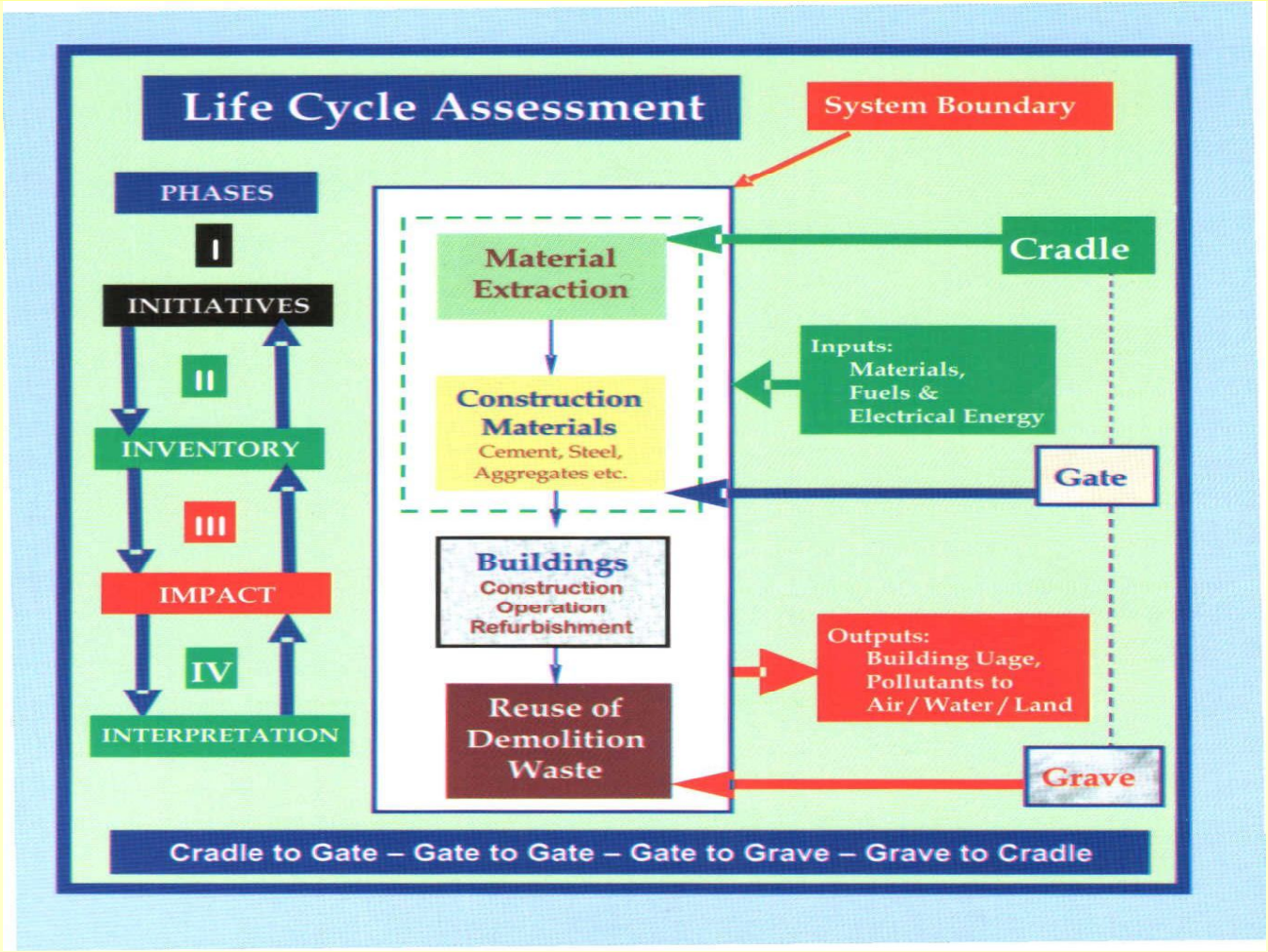
Brief of the project: *In this project work, a low cost, computer numerical controlled, eco-friendly welding (using friction stir welding principle) machine was successfully developed. The above machine is presently used to weld different materials such as wrought aluminium alloys, cast aluminium alloys, magnesium alloys, copper alloys, IF steel, mild steel and stainless steels. Further, the machine is also used to perform dissimilar welding of aluminium and magnesium alloy, friction stir spot welding and friction surfacing of materials. From this project work, following important conclusions are derived:*

- *It is found that the newly developed friction stir welding (FSW) process didn't produce gaseous emission, particulate emission and radiation during welding of above materials and hence it could be very much called as Eco-Friendly Welding process. Moreover, the joints fabricated by FSW process exhibited superior mechanical and metallurgical properties compared to other joints fabricated by conventional welding processes.*

- *The wrought aluminium alloy joints fabricated by FSW exhibited higher strength values and the enhancement in strength is approximately 34% compared to the GMAW joints and 28% compared to the GTAW joints.*
- *Tensile strength and hardness in mild steel joints indicated the overmatching of friction stir welded joints compared with the base metal. The joint efficiency was found to be 108 %. This is due the fine equiaxed structure of ferrite and pearlite of the stir zone.*

- *The stainless steel joints fabricated by FSW exhibited higher strength and the enhancement in strength is approximately 40% compared to GMAW joints, and 35 % compared to GTAW joints. Similarly, the joints fabricated by FSW exhibited higher impact toughness values and the enhancement in impact toughness is approximately 25% compared to GMAW joints, and 50% compared to GTAW joints.*

LIFE CYCLE ASSESSMENT FOR CONSTRUCTION INDUSTRY – CONCRETE BY NCCBM, HARYANA



Brief of the project: *The main objective of the project was to use Life Cycle Assessment is an effective analytical tool for the systematic evaluation of various environmental impacts either of a product or service system through extraction and processing of raw materials through manufacture, delivery, use and finally up to its waste management which is referred to as "Cradle–to–Grave". The study was to devise protocol for Life Cycle Assessment for construction Industry in the Indian scenario and to generate a widely applicable standard methodology for LCA in Construction Project and its use, development of baseline data for construction industry to assess the environmental efficiency and improvement, identification of potentials for conservation of materials and energy, access ways and means to reduce energy and raw material consumption, provide guidance in pollution prevention programmes through waste reduction and resource conservation opportunities, undertake assessment of life cycle impacts for the current practices and alternate improvement pathways, to promote eco-friendly construction activities etc.*

Integrating LCA into the green building design process, design and construction processional can evaluate the life cycle impacts of building materials, components and system and find out the alternate paths to choose the combinations that reduce the building's life cycle environment impact.

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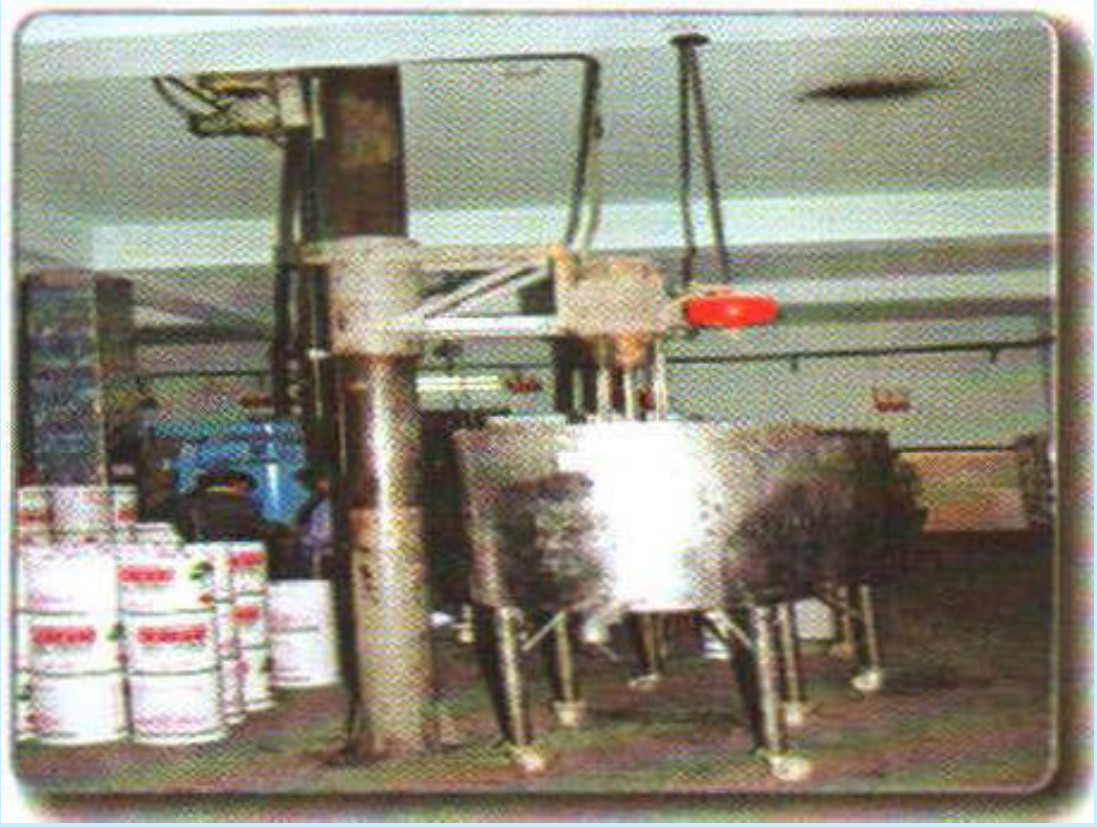
(7)

DEVELOPMENT & DEMONSTRATION OF ENVIRONMENTALLY SOUND TECHNOLOGY FOR REGENERATING/ RECOVERY/ RECYCLING OF PAINT SLUDGE" BY NATIONAL PRODUCTIVITY COUNCIL, NEW DELHI.



Brief of the project: *The objectives of the project are to develop & demonstrate environmentally sound technology for Re-processing/recovery/recycling of Paint Sludge from Automobile sector including ancillaries with the aim of converting Industrial paint Sludge (Hazardous Waste) to a usable product thus leading to conserving resources apart from reduced paint sludge disposal cost and environmental risk due to conventional paint sludge disposal practices. Secondly, to compare advantages and disadvantages of options for managing paint waste.*

In India, industrial paint production is about 2,10,000 kilo liters as per 2006-2007 data through leading industrial paint manufactures and its production is expected to grow at 12-15%. The automotive industry sector reportedly consumes about 63% of the industrial liquid paint i.e. 1,32,300/- kilo liters produced in the country while remaining 37% is consumed by non-listed small consumers. Due to partial utilization of paint (application efficiency) around 35% of paint are generated as paint sludge. Out of this quantity, about 65% is generated from large-scale units and remaining 35%

of sludge is from small-scale units. The paint sludge generation is a major environmental issue because as per Hazardous Waste (Management & Handling) Rules 1989 (2003 amendment).

Paints contain solvents, synthetic resins and metals and hence paint waste generated during usage is hazardous in nature. The priorities of management remains reduce, reuse, recycle, convert to useful product, recover valuable components, landfill and incinerate. After attaining practical limits of reduce, reuse and recycle options certain waste still remains to be managed. So far the options included incineration and land filling. A project conceptualized to convert paint waste to useful product. 32 million liters of liquid paint by the leading manufacturers of India which is used in automobile sector mostly generate paint sludge in the range of 40 to 45 million liters per annum. These paint sludge will be recycled and added with extra material and will be made reusable by this technology.

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Environmental Pollution Control in Agro-based Paper Industry by Implementation of Lignin Precipitation System (LPS) Technology

Brief of the project: *The agro residues based mills contribute around 22% of total paper & paper board production and playing a vital role in development of economy of rural area by providing of employment & procurement of raw material. In spite of having inherent problems, the small scale agro based mills are now facing severe environmental problem particularly management of black liquo0r as the chemical recovery process is not feasible for the mills having pulp mill capacity less than 100 tpd since most of these mills are manufacturing packaging grade paper where mills use low dosages of caustic compared to mills producing bleached grade paper. In absence of chemical recovery process these mills not only creating severe environmental problem due to discharge a black liquor but also loosing valuable biomass & chemicals used in process.*

The lignin precipitation process may be an alternate technology for black liquor management in these small scale pulp & paper mills. The studies conducted under the project ***Environmental Pollution Control in Agro based Paper Industry by Implementation of Lignin Precipitation System (LPS) Technology*** *has proved the techno-economic feasibility of this alternate option for treatment of black liquor. The LPS system can be integrated along with Biomethanation system as a pretreatment step to improve the overall efficiency of subsequent effluent treatment plant to meet the discharge norms.*

The viability of LPS sytem is very much dependent on the purity of the lignin separated, its conversion to value added products as well as market potential of the separated lignin. In all the successful full scale demonstration LPS system developed by ***M/s ABC Paper Ltd.*** *in collaboration with* ***Ministry of Environment & Forests*** *and conversion of separated lignin into value added products has proved the sustainability of the process for replication in small agro based mills which have limitations in adoption of chemical recovery system due to constraints of pulp production capacity and capital investment. The LPS can also be adopted by large scale pulp & paper mills which are planning to enhance production capacity but have limitation in adding new chemical recovery boiler due to high capital investment.*

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PILOT DEMONSTRATION OF CLEAN TECHNOLOGY FOR LANDFILL GAS (LFG) RECOVERY AT OKHLA SITE, BY TERI, NEW DELHI.

Brief of the project: *The main objective of the project was the Municipal Solid Waste (MSW) generated in the major cities of India is normally disposed of in unsecured landfills where it gradually decomposes to produce methane (CH_4) and carbon dioxide (CO_2), both considered as potent Green House Gases (GHGs). LFG contains carbon dioxide, methane, VOC, HAP, and odorous compounds that can adversely affect public health and the environment. The objective of the pilot demonstration project was to capture and recover the landfill gas currently being emitted from Okhla landfill site by using Clean Technology (CT) and thereby to utilize the energy and reduce the risk of uncontrolled methane emissions from landfill, which is a potential GHG. The Global objective was to reduce emissions of methane by recovering energy from Okhla landfill site through Clean Technology demonstration projects and to contribute to sustainable development in India by identifying and removing barriers in the adoption of clean technologies in waste management sector. The Environmental Benefits would include recovery and combustion of LFG that would otherwise be released in an uncontrolled manner from the landfills. Possibly the biggest health and environmental concerns are related to the uncontrolled surface emissions of LFG into the air.*

(10)

DEVELOPMENT OF FLY ASH BASED GEOPOLYMER CONCRETE PRECAST ELEMENTS TO ANNAMALAI UNIVERSITY, TAMIL NADU.

Brief of the project: *The main objective of the project was to use large quantities of fly ash to develop of an alternative concrete (geo-polymer concrete) to normal cement. Development of an alternative to cement will reduce the production of cement which is turn reduce the pumping of CO2 to the atmosphere. Also to save natural resources and vast area of land for ash pond to store it. The geo-polymer concrete developed can be used for Pre-cast Concrete elements like Railways sleepers, Electric power poles, Concrete bridges etc. the product have shown better strength than the cement.*

Low-calcium fly ash-based geopolymer concrete has an excellent compressive strength and is suitable for structural applications. The reason for the improvement in compressive strength of geopolymer concrete is the chemical reaction due to the speedy polymerization process and aging of the alkaline liquid. The geopolymer concrete specimen, the one cast with 8 Molarity NaOH solution showed higher strength compared with other molarity specimens because when H2Oto-Na2O molar ratio increases the strength of geopolymer concrete decreases. Geopolymer binders have emerged as one of the possible alternative to OPC binders due to their reported high early strength and resistance against acid and sulfate attack apart from its environmental friendliness.

(11)

MINIMIZATION OF ENVIRONMENTAL IMPACTS OF SLAUGHTER HOUSE WASTES BY VALUE ADDITION AS PET FOODS BY ALIGARH MUSLIM UNIVERSITY, ALIGARH.

Brief of the project: *The project was sanctioned to the Aligarh Muslim University, Aligarh (UP) with a duration of three years. The main objective of the project was to use the Slaughter House Waste as by product i.e. value added pet foods and bio fertilizers to have a better environmental management in this sector and to enhance the income of the meat processors. There is hardly any R&D work done on pet food to scientifically formulate them and produce in small sector in decentralized manner. On an average the wastes produced by the slaughter houses are 45% to 60% of the total meat product from cattle and buffaloes, sheep's and goats, etc. These animal wastes include hides, skins, bones, blood, urinal contents etc. These wastes are causing serious environmental problems as well health impacts. On the other hand if properly collected, conserved and processed they can be utilized for food, feed, duel and fertilizer. The economic value of such end products goes as high as 30 folds when compared to the value of the raw materials. Various slaughterhouse wastes like hides, skins, their trimmings, head, shank and tail hides are ideal for conversion into dog chews. Modern food processing technologies viz. thermoplastic extrusion and restructuring of meat has been utilized to produce animal feeds and pet foods of desired shape and characteristics. These pet food/feed can be safely stored for longer periods. Utilization of slaughterhouse waste products for food/feed of pets, poultry and fish etc will not only lead to minimize the impact of environmental problems but also produce value added products besides generating employment for thousands in rural areas.*

EVALUATION OF REFUSE DERIVED FUEL FROM WASTE PLASTICS AS ENGINE FUEL SUBSTITUTE BY ANNAMALAI UNIVERSITY, TAMIL NADU

Brief of the project: *In the project, an oil extraction plant has been designed and fabricated for cracking waste plastics and convert to oil. The features of the plant makes it suitable for controlling the process parameters like temperature, flow rate, resident time and condensation of the liquid product. In this process, fly ash has been used as a catalyst to crack the waste plastics. This reaction leads to generation of liquid and gaseous hydrocarbons as a desired product. The catalyst gives better yield under optimum conditions of temperature and flow rate and a yield of 90% of waste plastic derived oil on volume basis has been obtained. Distillation unit is used for the separation of petrol, diesel and kerosene, at different temperatures, when 60% of diesel, 30% of petrol and 10% of kerosene and other hydrocarbons are obtained. Properties of the waste plastic derived oil (density, specific gravity, flash point, fire point, calorific value and cetane number) are closer to those of the conventional fossil fuels. As the waste plastic derived oil has low sulphur content when compared to that of the conventional fuels, it would help reduce the environmental pollution (eg. acid rain) and improve the life of the exhaust systems. Waste plastic derived oil is cheaper cost-wise as compared to the price of petrol and diesel. The cost of waste plastic derived petrol per liter is Rs.40 and that of diesel is Rs.30 only.*

With the help of heavy capacity crusher, the plastic articles are shredded into pellets and fed into the melter whose temperature could be controlled through a panel. Mr. Saravanan further said that in breaking the pellets, fly ash was being used as a catalyst.

Flyash obtained from the Neyveli Lignite Corporation had been found ideal as it had all the required properties such as silica – 60 per cent, alumina – 13 per cent and iron – 15 per cent.
However, for the inert flyash to act as a catalyst it ought to be initially activated and the formula for the same had been kept a closely-guarded secret. Mr. Saravanan further said that with the catalyst it would take two hours to get 50 litres of fuel and without catalyst, 9 hours .
Temperature variance would determine the kind of output. For instance, petrol could be obtained at 100 degree Celsius and diesel, 150 degree Celsius. Gas would be a by-product that could be utilised for cooking purposes.

Mr. Saravanan also said that the fuel obtained from the unit was being used for running generator sets in the engineering faculty. He also demonstrated the use of the fuel in a motorcycle.
As the fuel thus obtained had low sulphur content, high cetane number and high calorific value, it would help in smooth functioning of engines. Production cost of diesel worked out to Rs. 25 a litre and that of petrol, Rs. 30 a litre. He said that the unit does not emit harmful gases or any odour.
Mr. Gopalakrishnan said that examination of residue from the unit was found to be free from any harmful effect, and even the small quantity of left-over substance could be profitably re-cycled.
University Administrator Shiv Das Meena suggested that patent could be obtained for the fuel unit and efforts should be made to disseminate knowledge about the technology.

Director (Clean energy) of Union Ministry of Environment and Forests M. Salahuddin congratulated the professors and their teams.

The project has been funded to the tune of Rs. 55 lakh by the Union Ministry of Environment and Forests

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