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Didier Lecomte, Ange Nzihou

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1st International Conference on Engineering for Waste Treatment

Beneficial Use of Waste and by-Products

The International Conference on Engineering for Waste Treatment: Beneficial Use of Waste and by-Products, 'WastEng2005' (17–19 May 2005, Albi, France) was a first attempt to bring together engineers and researchers in different fields of expertise to cover scientific, technological and regulation issues concerning waste treatment. This event, organized by the Ecole des Mines d'Albi-Carmaux (France), Paul Sabatier University of Toulouse (France), the CNRS PROMES Center in Odeillo (France), Tsinghua University (China) and the New Jersey Institute of Technology (USA), gathered 275 participants coming from 40 countries. Topics covered by the conference ranged from issues related to basic research to industrial development of new technologies and processes for the treatment and beneficial reuse of wastes: agricultural, industrial and municipal solid wastes, polluted soils and sediments as well as gas and liquid emissions.

During the three day meeting, presentations and discussions highlighted significant topics:

- New cutting-edge technologies and research on the pre-treatment methods, processes and environmental and sanitary evaluation strategies for better reuse of waste materials.
- Detailed descriptions of relevant concepts including their risk, environmental and economical assessments.
- Examples of new processes and pilot scale or industrial demonstrations.
- Legislative updates and tendencies.
- Barriers to conquer from the technical, legislative and society acceptance points of view to progress in the beneficial reuse of wastes.

During the post-conference workshop, held on Friday May 20th at the Ecole des Mines d'Albi, a working group of experts summarized the advances revealed during the various sessions. A consensus was reached to define the most promising results and needs for future research:

- Multidisciplinary networks need to be reinforced on the European and World scale in order to generate fruitful exchanges between specialists in process engineering, civil engineering, environmental and other sciences devoted to the treatment and beneficial reuse of wastes.

- More co-operation is needed at different levels of government, academia and industry. Support is required to build demonstration pilots for emerging technologies.
- Social stakes have to be taken into account to promote recycled materials and accept products and energy made with wastes each time this is possible. This policy will advantageously reduce waste stockpiling and land filling, help to preserve natural resources and reduce the fossil fuel consumption.

From the 230 papers in the proceedings, a selection of short papers was made for publication in this special issue with a special emphasis on waste-to-energy issues, waste beneficial use as agricultural matter or industrial material, and new process developments for the degradation of chemicals.

The production of *sludge* by an increasing number of urban or industrial wastewater plants and the difficulties in finding a suitable disposal route was an important discussion topic at the conference. Several papers related to wastewater and sludge treatment are included in this special issue as sludge can be viewed as an excellent illustration of the major trends in waste processing: degradation or destruction, energy conversion, agricultural reuse or transformation into high grade 'industrial like' materials.

The reclaiming of wastewater in dry areas such as in Perth (Australia) can be associated with the injection of the treated wastewater into coastal aquifers (Li *et al.*) allowing for further water purification, restoration of groundwater levels and prevention of saline water intrusion.

Reduction of sludge quantity can be performed using a combination of various treatments and anaerobic digestion. Paul *et al.* compared disintegration techniques, such as thermal (95°C), ozonation or hydrogen peroxide treatment.

A collective paper under the auspices of the EU framework program, the BIOWASTE project (Schmidt *et al.*) assessed the sustainability of sludge recycling on agricultural land. The benefits of sludge land spreading were assessed using a combination of scientific approaches in various fields (biotechnology, ecotoxicology, plant toxicology, microbiology, chemistry, LCA...) with important implications in current EU regulatory work.

The production of carbonaceous sorbents for the treatment of industrial wastewater is an alternative option for sludge beneficial use. In their paper Rio *et al.* optimized the different stages of carbon activation with sludge as

raw material and compared this valorization technique with standard disposal routes. Similarly, Orescanin *et al.* used bauxite waste (red mud) for the purification of industrial wastewater containing heavy metals.

As far as the energy yield is concerned, sludge may be considered as a potential solid fuel, but the main obstacle for *sludge derived fuel* production is the cost of energy for drying. A thermal drying process is described by Peregrina *et al.* Based on the concept of frying sludge with recycled cooking oil for the synthesis of a high grade solid fuel, this process is assessed by LCA (life cycle assessment) at the earliest stage of its design. Sludge degradation rates through anaerobic digestion can be enhanced by a thermal pre-treatment (130–170°C) with a benefit in biogas yields (Bougrier *et al.*). Gas production from anaerobic digestion can also be applied to agricultural by-products such as olive pulp with a special focus on hydrogen production (Koutrouli *et al.*). The incineration of *municipal solid waste* cannot merely be considered as a pure combustion problem, due to the heterogeneity of the solid load and the presence of heavy metals. Ménard *et al.* developed a 3D model of MSW incineration on a moving grate including thermodynamics calculations of heavy metals speciation in the solid and gas phases at different locations of the bed, post-combustion zone and boiler.

Incineration of low calorific value gases like VOCs both saves energy and allows for reduction in hazardous emissions. Porous media burners are studied both numerically and experimentally. These techniques allow a better flame stability and a good heat recovery.

The degradation of highly contaminated waste streams also necessitates the development of new processes or the optimization of existing ones. Kano *et al.* developed a non-thermal process for dechlorinating PVC, using mechanochemistry to transform organic chlorine into water-soluble chloride. The degradation kinetics of pharmaceutical effluents (typically halogenated pyridines) in wastewaters were studied by Papadaki *et al.* using UV radiation. Kawasaki *et al.* designed a supercritical water

reactor for the destruction of polychlorinated biphenyls (PCB) and dioxins. These examples illustrate the variety and the high potential of mechanical, thermal and chemical processes for waste treatment.

Since the WasteEng2005 conference, one year ago, economic changes have occurred worldwide and the constant increase of the price of raw materials and energy have brought the enormous amount of energy and material hidden in solid and liquid wastes under the spotlight. The application of the Kyoto protocol in 163 countries impacts the substitution by heavy industries (chemicals, cement, pulp and paper) of large tonnage of raw materials (including gaseous, liquid or solid fuels) by equivalent quantities of processed waste. There is a resulting demand for research in efficient technological solutions for gas separation and treatments in waste, biomass and by-products combustion, and water removal from waste and pollution control. Lastly, the development of inexpensive wastewater and solid waste processes will allow increased sustainability in developing and newly industrialized countries. This is a formidable challenge for researchers and chemical engineers. The next international conference, WasteEng2008, will focus on the Valorization of Waste as Energy and Useful Materials. It will be held in Patras, Greece, 3–5 June 2008.

Professor Didier Lecomte,
Ecole des Mines d'Albi-Carmaux, France
Editor, Energy and Alternative Energy Sources
and

Professor Ange Nzihou,
Ecole des Mines d'Albi-Carmaux, France
Chair of the organizing committee, WasteEng2005

Note: The proceedings of WasteEng2005 can be obtained by contacting Jean-Louis Dirion (dirion@enstimac.fr) or Ange Nzihou (nzihou@enstimac.fr). The conference web site is still available at <http://www.enstimac.fr/heberges/wasteeng2005>.