Master Thesis Proposal

A comprehensive tool to support the management of biosolids generated in waste water treatment plants

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The management of the disposal of biosolids (i.e. sewage sludge) that is generated during the water treatment process in wastewater treatment plants is a complex decision problem, which involves many factors such as economical costs, impact for humans and also in the ecosystem. The government encourages the reuse of sludge in order to achieve a sustainable water cycle. In the SOSTAQUA research project, a multi-disciplinary team evaluates all the factors to consider when deciding the best destination of sewage sludge from each plant.

During the last year, we have developed a tool to support this decision making problem, which combines the use of different intelligent methods (e.g. expert systems and fuzzy logic) with traditional multi-attribute decision making techniques (e.g. aggregation operators). However, at the moment, this system has two main limitations:

- The biosolids can have 3 possible destinations: apply them into agricultural land (as fertilizer), using them as fuel in cement (incineration) or deposit them in a landfill. The current system is only addressing the first case, evaluating the adequacy of each possible soil with respect to the characteristics of some particular sewage sludge.
- The result given to the decision maker is a set of preference values, which evaluate each combination of sludge and soil. However, the decision about the best distribution of sewage sludge at a more general level (e.g. regional level) is not supported.

The objective of this master thesis is to provide solutions for the current limitations of the system, in order to achieve a prototype able to give an integrated support for the management of biosolids.

To achieve this goal, the following tasks are proposed:

1. Study how to use the evaluations provided by the system (preference ratings for each soil and sludge) to recommend a possible distribution of the all the sewage sludge

produced in the wastewater treatment plants in a region. The case of Catalonia will be considered. Propose a solution and implement it.

2. Help to create the data model to treat the case of incineration of biosolids in cement, in co-operation with the experts that perform environmental studies, more. That means, participate in determining the alternatives, the criteria and its formalization.

3. Design and implement a decision support system for the case of incineration of sludge following the same structure of the current system (for agricultural soils). The systems should be easily integrated into a single platform.

4. Include an analysis of the impact of storing biosolids in landfills. It must be considered whether any additional tool is required to support this step.

5. To study whether the system can be improved by adding some other method of decision support to complement the existing ones (e.g. methods based on outranking relations).

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