

● Dr. Lopez Zavala Miguel Angel

<Profile>

Nationality: Mexican

Educational Background in Japan:

April 2001 – March 2004

Graduate school of Engineering, Hokkaido University (Doctor)

Major Field: Environmental Engineering

Present Institution / Status: Tecnologico De Monterrey /

Teacher



(Image) Dr. Lopez Zavala Miguel Angel

<Follow-up Research Fellowship>

Period: June 3, 2009 – August 1, 2009 (60 days)

Host University: Hokkaido University

Research Topic: Domestic graywater treatment by using a hybrid felt-membrane system

Outline of research

In this research, a Lab scale hybrid felt-membrane system is proposed to be evaluated as a potential alternative for direct filtration of different types of graywater discharges. The hypothesis here introduced is, the felt can be used as a pretreatment step of graywater discharges prior these are filtrated through the membrane modules. Felt is a low cost material that has been used successfully in extractors for removing grease and oil from cooking industry emissions. Thus, it is expected that important amounts of grease, oil, fibers, and solids can be retained in the felt fibers reducing the fouling of membrane modules. The final goal of this short research is to verify the effectiveness and feasibility of the hybrid felt-membrane to treat domestic graywater from several sources.

Results of research

The main results derived from the research conducted are summarized as follows:

- a) Characteristics of liquid and powder detergents are different. Powder detergents contain more solids, lower concentration of organic matter in terms of COD (chemical oxygen demand) and greater concentration of anionic surfactants (LAS).
- b) Detergents are the main contributor of organic loading of washing machine graywater, but the organic load will depend too on the type of cloths are washed. Underwear contributes greater on solids and COD than other cloths.
- c) Four different materials were evaluated as pre-filtration alternatives for direct membrane filtration of graywater. Wad, felt, compressed polyester and a three layers mixture of materials (including a plastic mesh). Felt and compressed polyester are prompted as potential pretreatment alternatives for direct filtration of gray water.
- d) Felt pre-filtration presented removal efficiencies of total solids (TS), total COD, dissolved organic carbon (DOC) and LAS on the order of 21, 10, 24 and 26%, respectively, in the case of graywater where liquid detergent was used.
- e) When powder detergent was used, the removal efficiencies during felt pre-filtration were up to 28% for TS, 19% for total COD, 17% for DOC and 12% for LAS.
- f) Felt pre-filtration has a positive effect on microfiltration performance because contributes on attenuating the membrane fouling when graywater is filtered. The effect is more remarkable when powder detergent is used.

Further research plan

The research just started; therefore, a lot of work is needed to be conducted regarding the potential use of felt as a pre-filtration alternative. I will continue the research in my university; specifically, the following issues must be evaluated:

- a) Effect of felt pre-filtration on nanofiltration performance when washing machine graywater is filtered.
- b) Pre-filtration of kitchen sink graywater.
- c) Effect of felt pre-filtration on micro and nanofiltration performance when kitchen sink graywater is filtered.

● Research Advisor: Professor FUNAMIZU Naoyuki

Outline of research

When Professor Lopez Zavala was in Hokkaido University as a Ph.D students, he worked on the composting toilet which is key technology of on-site differentiable wastewater treatment based on the concept “Don’ t Mix” and “Don’ t Collect” wastewater. Now he expands his research work to on-site grey water treatment and reuse, which topics are also studied in our laboratory. He is proposing the hybrid felt-membrane system as a potential alternative for direct filtration of different types of graywater discharges based on the hypothesis that the felt can be used as a pretreatment step of graywater discharges prior these are filtrated through the membrane modules. In this research, I advised him to include the characterization of washing machine wastewater in terms of their size distribution along with filtration test by the system with pre-filter + Nano Filter and/or pre-filter+ Micro filter. As to the parameters to be monitored, he learned the protocols of LAS concentration in water.

Results of research

The main results derived from the research conducted are summarized as follows:

- g) Characteristics of liquid and powder detergents are different. Powder detergents contain more solids, lower concentration of organic matter in terms of COD (chemical oxygen demand) and greater concentration of anionic surfactants (LAS).
- h) Detergents are the main contributor of organic loading of washing machine graywater, but the organic load will depend too on the type of cloths are washed. Underwear contributes greater on solids and COD than other cloths.
- i) Four different materials were evaluated as pre-filtration alternatives for direct membrane filtration of graywater. Wad, felt, compressed polyester and a three layers mixture of materials (including a plastic mesh). Felt and compressed polyester are prompted as potential pretreatment alternatives for direct filtration of gray water.
- j) Felt pre-filtration presented removal efficiencies of total solids (TS), total COD, dissolved organic carbon (DOC) and LAS on the order of 21, 10, 24 and 26%, respectively, in the case of graywater where liquid detergent was used.

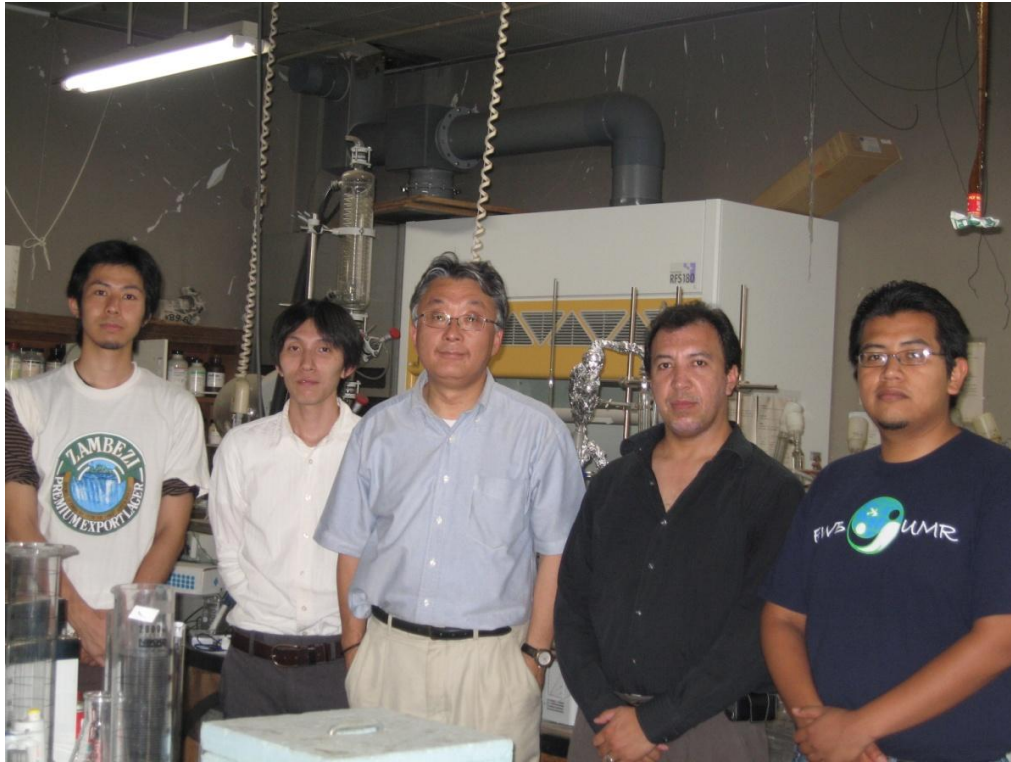
- k) When powder detergent was used, the removal efficiencies during felt pre-filtration were up to 28% for TS, 19% for total COD, 17% for DOC and 12% for LAS.
- l) Felt pre-filtration has a positive effect on microfiltration performance because contributes on attenuating the membrane fouling when graywater is filtered. The effect is more remarkable when powder detergent is used.

Above main results, conclusions (a) and (b) are obtained by experiments for characterizing of washing machine wastewater based on the suggestion. And the evaluation of LAS concentration was very effective for evaluating the performance of direct filtration systems examined in this study. During this short term stay, Professor Lopez Zavala has obtained the technique for LAS detection and he learned how to approach to the theoretical discussion on the performance of the direct filtration system for grey water.

Further research plan

The further collaboration research plan has been agreed between both sides, and we have started to work for making MOU between the graduate school of Engineering Hokkaido University and Tecnológico De Monterrey for further collaboration research and mutual exchange which includes the exchange program of graduate students. As to the research work on evaluating the potential use of felt as a pre-filtration alternative. the following issues must be evaluated by both sides:

- d) Effect of felt pre-filtration on nanofiltration performance when washing machine graywater is filtered.
- e) Pre-filtration of kitchen sink graywater.
- f) Effect of felt pre-filtration on micro and nanofiltration performance when kitchen sink graywater is filtered.



Laboratory of Engineering for Sustainable Sanitation, Hokkaido University. 2009