



LIFE BITMAPS

Pilot technology for aerobic Biodegradation of spent TMAH Photoresist solution in Semiconductor industries

NEWSLETTER No. 2

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Let's take stock of the BITMAPS project

Project purpose

The purpose of LIFE BITMAPS project is to demonstrate a new and innovative process for the treatment of effluents from the E&S (Electronic & Semiconductor) manufacturing processes. BITMAPS core activity entails design, construction and validation of a semi-industrial pilot plant to enable the treatment of spent photoresist/tetramethylammonium hydroxide (PR/TMAH), and other mixed solutions generated by the E&S industrial sector – more details about the chemical and physical features of these waste streams are available consulting the project website at www.lifebitmaps.eu -.

The most important expected outcome of the project is to prove, at industrial scale, the economical and environmental sustainability for biodegradation of TMAH to non-toxic biomass plus NH₃ by using some specific savage microorganisms selected during the R&D phase.

Project updates

The engineering and construction phase revealed quite complex along the project planning, considering variety and number of components required to ensure the proper arrangement and performances of the pilot.

The plant, which has been finally released for the preliminary tests in June 2018, is composed by two separate sections: one dedicated to the biological treatment of waste TMAH and the other for the chemical-physical treatment of acids mix solution and ammonium fluoride solution. Once completed the preliminary tests in the summer, some mechanical slight modifications were executed in October for the section dedicated to TMAH treatment in order to improve the plant availability and allowing to complete the plant tests in a "standalone mode". Further tests are currently being conducted in order to prove the concrete possibility to interconnect such a treatment plant with the civil waste water plant of the LFoundry semiconductor site thus completing the experimental phase of BITMAPS.

The gathering of the whole set of experimental results as well as of the lessons learned revealed through the conduction of the pilot plant represent the foundation in the last phase of the project to prepare a business case on the proposed technology. Besides the technical feasibility, it will demonstrate at industrial scale, the economic advantages as well as all the environmental ones that a company could benefit by adopting the solution developed through BITMAPS in terms of treatment method for the waste TMAH.

For specific information about BITMAPS refer to the project web site: www.lifebitmaps.eu

Pilot plant

The treatment sections of the pilot have been assembled inside two aligned containers (30 ft. each) and connected with an external scrubber for the abatement of air emissions.

All these systems are placed on a concrete and chemical proof platform to prevent any possible subsoil contamination in case of leakages.



TMAH is directly fed to the pilot from the site collecting tank of that waste, whereas ammonium fluoride and acid mix wastewaters are automatically transferred by the operator inside the dedicated section of the plant from drums temporarily connected to it.

Besides the power systems, the first container includes also the biological section made by three reactors operating in sequence to accelerate the TMAH degradation. This section can be operated for a wide range of TMAH input flows.



Picture 2 - Biological Reactors



Picture 3 - Chemical-physical section: filter-press

All the volatile substances deriving from each treatment sections are captured and conveyed to the scrubber in order to minimize air emissions.

The output liquid streams from the two treatment sections are collected and sent to the site biological treatment plant.

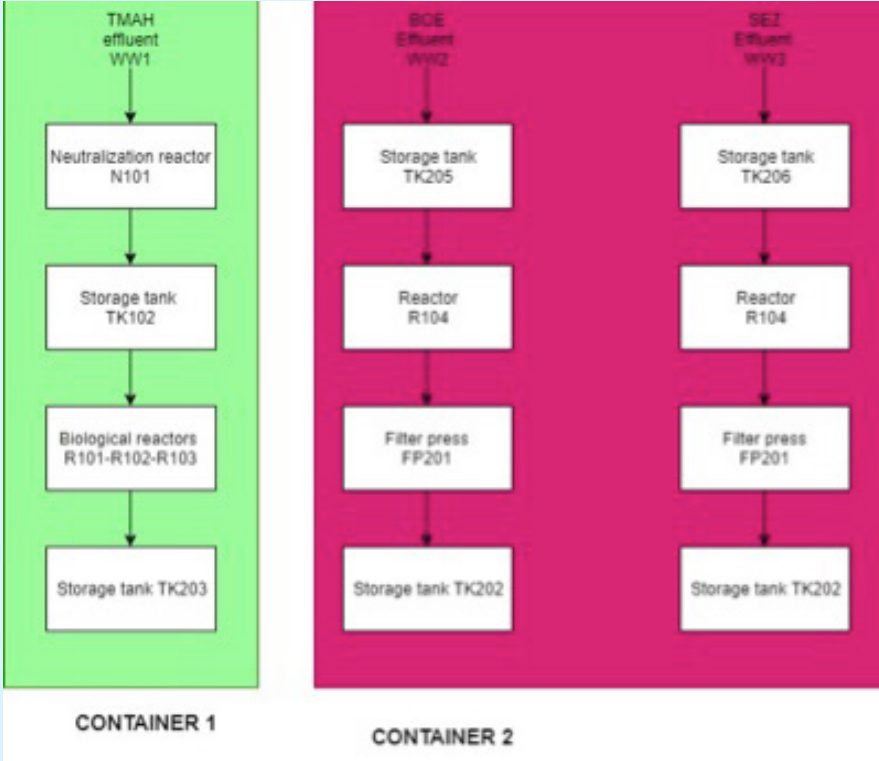
The other container hosts a chemical-physical section including a reactor and a small filter-press.



Picture 4
Air abatement system

Pilot treatment results

Simplified block diagrams of the processes carried out in the two sections (biological and chemical sections) of the pilot plant:



Experimental results have showed that the highest TMAH degradation happens in percentage in the reactor R101. More in details, tests carried out on the pilot plant have shown that about 60% of TMAH is degraded in the first reactor. Degradation yield rises up to 90% in the second reactor and reaches 99% in the third reactor. This value of TMAH removal yield allows to classified pilot plant effluent not-harmful for the bacterial flora of any civil wastewater treatment plant.

Even the bacterial populations are differentiated in the three reactors. Bacteria classification has shown that the flora of the first reactor has more specialized for the degradation of TMAH while, in the other reactors, bacterial strains able to carry out conduct other biological processes (e.g. nitrification) are present.

The treatments arranged for the two wastewaters containing respectively a mix of acids (named "SEZ") and the ammonium fluoride, (named "BOE") have been carried out by adding lime. These processes, have led to the reduction of 98% of fluorides at the final discharge from the pilot plant.

Environmental performance

Environmental performance is fundamental to meet the prescriptions given with the plant permit and an indirect significant evidence to testify the cost effectiveness of the proposed solution compared with other plants adopting different technologies.

A preliminary LCA (Life Cycle Assessment) has been conducted for the pilot plant) whereas a thorough LCA and LCC (Life Cycle Cost) for the plant scale-up will be finalized by the end of the project.

In terms of air emissions, negligible concentrations have been measured for the foreseen pollutants (NH₃, dust acids) deriving from the biological and chemical-physical processes even in the case they were simultaneously operated.

The plant doesn't produce liquid waste to be send to external plants for disposal. The solid wastes (sludges) resulting from the chemical-physical line of the pilot, for both the treated streams (ammonium fluoride and acid mix solutions) have been classified as "non-hazardous" (CER code 06 05 03).

The output liquid streams from the two treatment sections have been characterized as appropriate to feed the downstream civil treatment plant of the facility without impact for the environmental performance of that pre-existing plant.



Upcoming 2019 BITMAPS dates and Water Events in Europe

Engineering with Membranes 2019

April 8–10, 2019, Bastad, Sweden

<http://ewm2019.eu>

The International Conference on Sustainable Water Treatment Technologies and Environment (SUST_Water 2019)

April 14–19, 2019, Tipaza, Algeria

<http://udes.cder.dz/sustwater2019/>

RW- 586th International Conference on Chemical and Biochemical Engineering (ICCBE)

April 27–28, 2019, Manila, Philippines (BITMAPs Consortium will deliver a speech)

<http://researchworld.org/Conference2019/Philippines/1/ICCBE/>

The 16th IWA Leading Edge Conference on Water and Wastewater Technologies

June 10–15, 2019, Edinburgh – United Kingdom

<http://iwa-let.org/>

Ecology & Safety 28th International Conference

June 28–July 2, 2019, Burgas – Bulgaria

<http://iwa-let.org/>

The International Society for Engineers and Researchers (ISER)

August 5–6 2019, Auckland, New Zealand (BITMAPs Consortium will deliver a speech)

<http://iser.co/Conference2019/NewZealand/3/ICCES/>



16th International Conference on Environmental Science and Technology

September 4–7, 2019, Rhodes, Greece (BITMAPs Consortium

will deliver a speech)

<https://cest2019.gnest.org/>

NORDIWA - Nordic Waste Water Conference

September 23–25, 2019, Helsinki, Finland

<https://www.nordiwa.org/>

17th International Waste Management and Landfill Symposium

September 30–October 04, 2019, Forte Village, Cagliari, Italy

(BITMAPs Consortium will deliver a speech)

<https://www.sardiniasymposium.it/>

2nd International Conference of Environment: Survival and Sustainability

October 7–11, 2019, Near East University, Nicosia Northern

Cyprus

<http://www.ess2019.con.neu.edu.tr/>

Filtech - The Filtration Event 2019

October 22–24, 2019, Cologne – Germany

<https://filtech.de/>

Ecomondo "the green technology expo" 2019

November 5–8, 2019, Rimini, Italia (BITMAPs Consortium will

deliver a speech)

<https://www.ecomondo.com/>

7th Maghreb Conference on Desalination and Water Treatment CMTDE 2019

December 22–25, 2019, Hammamet, Tunisia

<http://desline.com/Flyer%201-CMTDE.JPG>

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