Research Summary Sheet

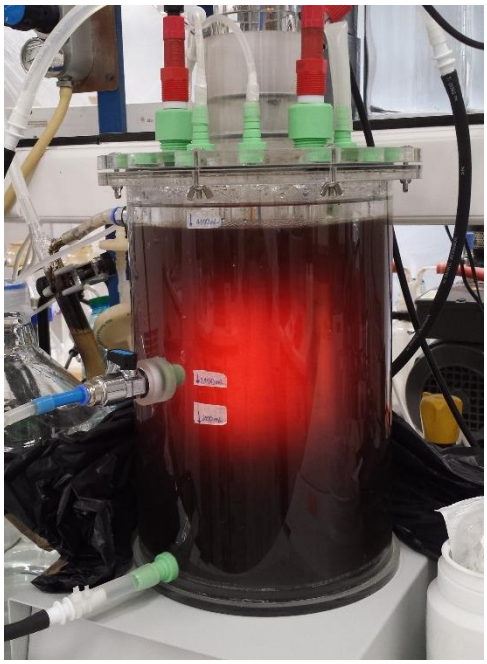
Converting agricultural wastes into polyhydroxyalkanoates using photosynthetic mixed cultures

Context and Challenges

The conversion of agricultural wastes into value added products is both economically and environmentally desirable. Currently, several chain processes are being developed in the NoAW project that allow the step conversion of manure and maize silage waste into methane and polyhydroxyalkanoates (PHAs). In one of the steps, these agricultural wastes are fermented into organic acids, which are the ideal building blocks for PHAs production. PHAs are biodegradable polymers with physical and chemical properties similar to conventional plastics, thus being generally called as bioplastics. These bioplastics can be biologically synthetized with mixed microbial cultures fed with the organic acids obtained from the wastes. Typically, these microbial cultures require intensive aeration which can increase the cost of the final PHA product. In the NoAW project, the challenge is to develop a process that uses photosynthetic organisms that instead of aeration can use free sunlight, thus decreasing PHA production costs.

Results and Applications

Currently, organic acids are being used to enrich a microbial sludge in photosynthetic organisms capable of producing PHA. The best photosynthetic organisms to do so are the purple bacteria that give a characteristic red colour to the culture (see figure). This process occurs in an illuminated photo-bioreactor that has light/dark cycles that simulate the day light. At the moment results indicate a capability of the culture to accumulate up to 20% PHA, a value that we intend to optimize during the next months of operation.



The project leading to this application has funding from European Union's Horizon 2020 research and innovation programme under grant agreement No 688338.

Breakthroughs, benefits and added value

The operation of a photosynthetic process eliminates the need of aeration typically required in the current PHA production processes with mixed microbial cultures. The elimination of aeration and its replacement with free sunlight can lead to a substantial decrease of the operating costs. With a more competitive price, PHA may find its place in the market and replace conventional plastics in several applications, like in groceries packaging or in agricultural mulches, leading to more sustainable practices.

Further information on NoAW project: *http://noaw2020.eu*

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