

# Micro-, Lab-, Pilot- and Industrial Scale Based Biocatalytic Processes for Waste Management

Bruno Zelić<sup>1,2</sup>

<sup>1</sup>*University of Zagreb, Faculty of Chemical Engineering and Technology, Marulićev trg 19, HR-10 000 Zagreb, Croatia*

<sup>2</sup>*University North, Trg dr. Žarka Dolinara 1, HR-48 000 Koprivnica, Croatia*

Today, one third of the food produced in the world for human consumption, i.e. about 1.3 billion tonnes, is lost or wasted every year. It should be noted that 95% of discarded food ends up in the land fields where it produces methane (CH<sub>4</sub>), carbon dioxide (CO<sub>2</sub>), hydrogen sulfide (H<sub>2</sub>S), ammonia (NH<sub>4</sub>), hydrogen (H<sub>2</sub>), organic sulfur compounds and various acid gases or aerosols. As the availability and accessibility of fossil fuels is decreasing significantly, the production of biofuels from food waste and biomass is becoming increasingly interesting. Biodegradability, non-toxicity and low pollutant emissions are just some of the properties that make biogas, bioethanol, biohydrogen and biodiesel environmentally friendly fuels.

Micro devices are used in various areas of the chemical and pharmaceutical industries, biotechnology and medicine. Recently, the application of micro devices in the production of biofuels from waste and renewable sources has become increasingly important. At the same time, the small dimensions of these devices do not pose a problem in the production of large quantities of products, in this case biofuel.

In addition to the microsystems, the classic macrosystems for the biological treatment of waste, such as composting, must of course not be forgotten in the management of food waste. A particular challenge in waste management is the application of the 2<sup>nd</sup> and 3<sup>rd</sup> biological stage of municipal wastewater treatment in sparsely populated karst areas, where one of the possible solutions is the use of biorotors.

Selected examples are used to demonstrate environmentally friendly and economical technologies for efficient food waste management on a micro, laboratory, pilot and industrial scale.

**Keywords:** food waste, micro devices, biofuels, composting, biorotors