P4SB – From Plastic waste to Plastic value using *Pseudomonas putida* Synthetic Biology

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Two hundred and seventy five million tons of plastic waste were produced in 2010 alone (Jambeck *et al.*, 2015), with Europe accounting for about 55 million tons/year. The environmental impact of these primarily fossil-based plastics has been broadly discussed. While the vast majority of these polymers are not biodegradable, their strength and light weight provide comparative advantages. Poly(ethylene terephthalate) (PET), for instance, has contributed significantly to reducing energy expenditure during transport, especially QQin the beverage industry. Due to its thermoplastic nature PET is also easy to recycle. However, recycled PET is of lower quality and current recycled PET products struggle to compete with virgin PET on price and quality, leading to an overall European recycling rate of less than 30%. Polyurethanes (PU), are used extensively in a wide range of applications including construction, transportation, furniture, and medicine. Since many PU types have a thermoset nature with covalent bonds, one of the main concerns for this product is the notable lack of end-of-life recycling (<5%). Hence, new ideas that give room for new incentives are required for the recycling of plastics.

We here propose a strategy that allows upcycling of plastic waste, by feeding degraded plastic as carbon source to microbial plastic producers (1). In detail, the enzymatic degradation of PET and the possibilities to produce PHA from the resulting molecules will be presented. In addition, synthetic biology possibilities to improve the bioplastic producing microbe, *Pseudomonas putida*, will be shown. Finally, the potential contributions to a more sustainable plastic industry will be discussed.

(1) Wierckx N., A. Prieto, P. Pomposiello, V. de Lorenzo, K. O'Connor, and L. M. Blank, Plastic waste as a novel substrate for industrial biotechnology, Microbial Biotechnology, 2015, 8: 900–903