Project title: Plastic composting: development of a bioreactor for microbial plastic conversion

Project leader: Dr. Menno Knetsch

Function: Associate Professor: Dept. Biobased Materials, Maastricht University & Aachen Maastricht Institute for Biobased Materials, Maastricht University, Maastricht, The Netherlands.

Collaborators: Dr. Katie Saralidze, Dr. Luisa Bortesi, Dr. Stefan Rasche: Aachen Maastricht Institute for Biobased Materials, Maastricht University, Maastricht, The Netherlands.

Proposal (250 words):

Introduction: Plastics have driven technological development and shaped modern society. These synthetic materials are used in numerous applications in every aspect of society: Plastics are everywhere. Despite their success, plastics are associated with environmental pollution: Plastics are also everywhere we don't want them. Since plastics are very stable, they persist in the environment and often get dispersed as microplastics, leading to ecotoxicity, accumulation in food-webs and contamination of food sources. Plastic waste is threatening the planet. **Hypothesis and Objectives**: Main objective is to develop a bioreactor that uses microbial organisms (bacteria, fungi and archaea) to degrade and convert plastics. The hypothesis is that a combination of different microorganisms can efficiently transform plastics into biomass and high-value products. **Setting and Methods**: Currently many different bacteria and fungi have been identified that can degrade all common plastics (poly-esters, poly-ethylene, poly-urethane, poly-propylene, etc.). Our plan is to use such organisms to develop a novel strategy for dealing with plastic waste. The steps will be: i) creation of a database, organizing detailed information on microorganisms that can degrade plastics; ii) combine microorganisms with similar growth conditions to create a cocktail that can simultaneously degrade a mixture of plastics, iii) genetically modify microorganisms to produce biomass and designer products. **Impact**: Plastic pollution is an increasing threat, with virtually every ecosystem being contaminated with (micro)plastics. Plastic recycling and re-use are possible, but combustion and/or land-fill are still the most prominent end-of-life options. This alternative end-of-life option, "Plastic composting", will have profound impact on plastic waste strategies.

Requirements candidate: Highly motivated student with good English communication skills and proactive and resolute attitude.

Keywords: plastic, pollution, recycling, database, bioreactor, compost, biodegradation, microorganisms, waste, sustainability

Top 5 selected, relevant publications:

1. MLW Knetsch & LH Koole. New Strategies in the Development of Antimicrobial Coatings: The Example of Increasing Usage of Silver and Silver Nanoparticles (2011) Polymers 3(1), 340-366. (191 citations)
2. MLW Knetsch, M Wang, BE Snaar-Jagalska, S Heimovaara-Dijkstra. Abscisic acid induces mitogen-activated protein kinase activation in barley aleurone protoplasts. (1996) Plant Cell 8(6), 1061-1067. (citations 172)
3. KN Stevens, S Croes, RS Boersma, EE Stobberingh, C van der Marel, FH van der Veen, **MLW Knetsch**, LH Koole. Hydrophilic surface coatings with embedded biocidal silver nanoparticles and sodium heparin for central venous catheters. (2011) *Biomaterials* **32(5)**, 1264-1269. (43 citations)
4. K Saralidze, CSJ van Hooy-Corstjens, LH Koole, MLW Knetsch. New acrylic microspheres for arterial embolization: Combining radiopacity for precise localization with immobilized thrombin to trigger local blood coagulation. (2007) Biomaterials 28(15), 2457-2464. (40 citations)
5. MLW Knetsch et al. Expression vectors for studying cytoskeletal proteins in *DIctyostelium discoideum*.(2002) J Muscle Res Cell Motility 23(7-8), 605-611. (23 citations)