11 SUSTAINABLE CITIES AND COMMUNITIES

Industrial biotechnology – helping make cities resilient and sustainable

The eleventh UN Sustainable Development Goal – *make cities and human settlements inclusive, safe, resilient and sustainable* – aims to address the impacts of rapid urban population growth including unplanned urban sprawl, slum dwelling, increased air pollution and inadequate basic services and infrastructure. By 2030, the world's city-dwelling population is expected to rise from 4 billion to 5 billion people.[1]

Industrial biotechnology harnesses the power of naturally occurring microbes and their components (e.g. enzymes) to convert municipal solid waste into fuels and other materials for industry, to improve urban air quality and to provide innovative solutions for waste water treatment. Each of these applications helps to make human settlements more inclusive, safe, resilient and sustainable.

SUSTAINABLE DEVELOPMENT GOALS

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USING BIO-BASED SOLUTIONS CREATE AN ECONOMIC INCENTIVE FOR THE REMOVAL OF SOLID WASTE

World Bank statistics reveal that 10 percent of global solid waste is plastic, 17 percent is paper and 46% is organic.[2] Other categories include metal and glass. The safe removal and management of solid waste represents one of the most vital urban environmental services. Uncollected solid waste blocks drains, causes flooding, and may lead to the spread of water-borne diseases.

Industrial biotechnology helps to enable the circular economy, in which new uses and value can be found from so-called 'waste streams' and products at their 'end-of-life'. For example:

Improving separate collection and endless recycling of plastic waste

The use of innovative enzymes in the plastic recycling process makes de-polymerisation possible, by converting PET (the polymer most often used in plastic bottles) to its original monomers, which can be used in new products. Another example, biodegradable and compostable plastic bags, have been designed (in accordance with standards such as EN13432 – which sets requirements and test methodologies to evaluate if a plastic is biodegradable and compostable) to biodegrade along with other organic waste in composting facilities. As a result, they can offer a key advantage when it comes to the logistics of bio-waste recycling from households, since at the composting site there is no need to laboriously remove the collection bags. Compost is a valuable tool that can be used to replace carbon in soil and combat desertification.

Turning waste into a renewable energy source

Enzymes can play a crucial role in extracting many important resources from waste. Particularly, enzymes are largely used to produce biogas. Biogas is methane produced by a biological process where micro-organisms convert organic waste such as biomass, manure, sewage or municipal waste, green waste, in the absence of oxygen. This conversion can happen in different ways. For example, a modern technology allows enzymes to convert the organic fraction of unsorted municipal waste into liquid. The liquid is then used to produce biogas, which can be used for green power for the plant itself. Moreover, using the residues of one industry as feedstock for another can contribute to industrial symbiosis. Here, enzymes can convert residual products of one industry into biogas.

USING BIO-BASED SOLUTIONS TO IMPROVE URBAN AIR QUALITY

Air pollution is a major environmental health risk. In 2014, 9 of 10 people who lived in cities were breathing air that did not comply with the safety standard set by the WHO.[3] Together with electrification, blending of bioethanol into transport fuels can provide significant benefits in urban air quality through reduction of particulates when compared with petrol or diesel fuels.

Renewable ethanol is a cost-effective and readily available means of decarbonising transport. Also, blending bioethanol into conventional transport fuels can provide benefits in urban air quality through reduction of particulates compared with petrol or diesel fuels.[4] The oxygen content of ethanol helps to improve combustion, and, with the decrease of petrol, results in a decrease of certain emissions such as particulate matter. Higher levels of ethanol added to petrol, such as E20, could make a substantial reduction to the emissions of CO_2, CO and HC emissions from petrol cars.[5]

Biogas and biofuel can also help to reduce emissions by capturing and reusing greenhouse gases like methane, nitrous dioxide and carbon dioxide that are usually released into the atmosphere when manure and waste decompose.

USING BIO-BASED SOLUTIONS TO ENSURE MUNICIPAL WASTE-WATER TREATMENT

Municipal and industrial processes account for a large proportion of global freshwater consumption. In addition, both can leave large volumes of water unpotable and unused. Industrial biotechnology has given scientists the tools to create innovative bio-based solutions that efficiently treat municipal and industrial waste water, and control effluent re-joining the water supply. Microorganisms in waste water treatment help to degrade some contaminants improving the treatment systems. This results in less use of chemicals and resources. Furthermore, enzymes and microorganism are used in municipal waste water treatment lagoons to reduce the volume of sludge improving the water treatment and offering a sustainable cost-effective solution to the community.

Cities are expected to represent the largest share of growth in freshwater demand to 2030, meaning that innovative solutions to meet municipal water needs will be crucial. Microbes are at the heart of modern municipal waste-water systems. They help detect which contaminants are present and to produce effective enzymes which help break them down.

DID YOU KNOW?

- On the basis of data from cities in 101 countries from 2009 to 2013, only 65% of the urban population was served by municipal waste collection.[6]
- As of May 2017, 149 countries were developing national-level urban policies.[7]
- The transport sector alone accounts for around 25% of total EU GHG emissions.[8]
- European biorefineries produced 5.84 billion litres of renewable ethanol in 2017 more than three-quarters of which was utilised for transport, resulting in 70% savings in GHG emissions compared to petrol.[9]

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1 See The United Nations Sustainable Development Goals
2 See World Bank knowledge paper on 'Waste Composition'
3 See The United Nations Sustainable Development Knowledge Platform
4 See European Commission (2017), 'Impact of higher levels of bio components in transport fuels'
5 See ePURE 'About Ethanol' webpage
6 See The United Nations Sustainable Development Knowledge Platform
7 Ibid
8 See European Environment Agency's 'Greenhouse gas emissions from transport' webpage
9 See ePURE 'European renewable ethanol – key figures 2017' factsheet

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