Creating a material that mimics dolphin skin amongst new scheme's research collaborations

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Dolphin skin material could reduce the amount of energy used to pump huge volumes of water through vast networks of water pipes.

Researchers from Imperial College London and University College London are planning to develop a new material that mimics dolphin skin, so that water can flow more efficiently down pipes, in one of seven early-stage projects that will receive support from a new scheme announced today.

The Kick-Start scheme aims to advance engineering research and promote collaborations between the two universities. They have

distributed one hundred thousand pounds in seed funding among projects that also include an initiative to make power plants that use energy from waste more sustainable. The seed funding will help teams to establish their collaborative projects and pursue further funding to get their research to the next level. The scheme is an initiative of the Faculty of Engineering at Imperial and the School of the Built Environment, Engineering and Mathematical and Physical Sciences at UCL.

Professor Jeff Magee, Principal of the Faculty of Engineering at Imperial, says:

“From improving the way that water is managed to enhancing the way that energy is generated, this scheme provides vital seed funding to get some innovative projects off the ground. We think our wealth of outstanding researchers, the close proximity of both institutions and the complementary areas of research at both universities will make it easier for these collaborations to work well. I look forward to seeing how these projects have evolved in the next few years.”

Two of the new scheme’s projects are:

Super-smooth pipes

Many arid countries around the world such as Australia and Libya rely on vast pipeline networks to transport water to areas where it is scarce. However, the resistance between the pipe walls and the flowing water causes friction, which means that huge amounts of energy has to be used to pump the large volume of water to its destination.

To address this, Dr. Michael Templeton, from the Department of Civil and Environmental Engineering at Imperial, and Dr Andrew Wills, from the Department of Chemistry at UCL, aim to develop a new material that reduces this friction. They plan to mimic the special chemical

properties and physical structure at the microscopic level of some of the most slippery surfaces in nature. One of the surfaces that they are exploring is dolphin skin.

Chemicals combine with tiny bumps on the animal's skin to reduce the friction between the Dolphin and the water that it is swimming through. Similarly, the new material could have nanoscopic bumps, which will control the water flow, making it run more easily over the surface. It will also be coated with water repellent chemicals that will reduce the friction between water particles and pipe surface.

The expectation is that the new material will be in a form that could be applied to the inside of pipes, either as a material that lines the pipes or as a spray.

The team believe that there may also be applications for this material in other industries that require long-distance transport of fluids, such as the oil and gas industry.

Improving the sustainability of power plants that generate energy from waste

Making power plants that burn waste to produce energy more sustainable and efficient will be the focus of the project run by Professor Chris Cheeseman, from the Department of Civil and Environmental Engineering at Imperial, and Dr. Julia Stegemann, from the Department of Civil, Environmental and Geomatic Engineering at UCL.

These power plants burn waste that cannot be recycled by any other means. The heat generated from the combustion process is used to create steam, which powers a turbine to generate electricity. The plants can also produce hot water that can be distributed to local communities.

Currently, there is significant public opposition in the UK to the construction of new plants, which are called “Energy from Waste Plants”, because they are seen as environmentally unfriendly, emitting CO_2 and other pollutants into the atmosphere. As a result, the UK lags significantly behind many other European countries, with 24 Energy from Waste Plants, in contrast to others such as France, which has around 130.

The researchers believe that these power plants have the potential to make a significant contribution to energy supply in the UK. Current estimates have shown that about 10 percent of the UK’s energy requirements could come from waste, which could provide a secure source of energy for the country.

The researchers have received seed funding to kick-start a wide ranging project, which will involve stakeholders such as community groups and Energy from Waste Service providers.

They will investigate new ways to extract resources from the residues at the end of the combustion process, which include metals such as steel, aluminium and tin. The researchers will also investigate ways in which the energy generated from the process can be used more efficiently. This could include exporting excess heat, generated from the plant, to local communities.

The team will develop new methodologies for characterising the types of waste going into these facilities. Knowing more about the type of waste that is being combusted will enable the researchers to calculate how much comes from renewable sources such as plant material, which is called biomass. Knowing the percentage of biomass used in the combustion process will enable Energy from Waste companies to charge more for their energy because it comes from a sustainable resource.

The team will also carry out research that aims to understand and resolve the public concerns and planning issues associated with developing new energy from waste infrastructure.

Provided by Imperial College London