This thesis presents work that was done within the Swedish Centre for Resource Recovery (SCRR). Research and education performed within SCRR identifies new and improved methods to convert residuals into value-added products. SCRR covers technical, environmental and social aspects of sustainable resource recovery.

Concerns over greenhouse gas emissions and energy insecurity have increased the need for research into energy generation from renewable sources, for example, biofuels. Fossil fuels are not green but remain inexpensive to replace. The cost of alternative energy sources must be reduced to compete with fossil fuels. One way for that is to reduce the initial investment of biofuel production plants. The main cost of such plants is the initial investment in the land and infrastructure, including utility, design, etc., among which the investment in the heart of the plant –the bioreactor– is a significant figure.

The primary goal of this thesis was to develop a new material of construction for producing a biofuel reactor, which can serve as an alternative to the current stainless-steel-/concrete-based bioreactors. One approach is the replacement of costly conventional bioreactors with cost-effective textile bioreactors. PVC-coated polyester textile (PVCT) has been used for this purpose to make bioreactors more cost-effective and easier to install. In this thesis, the thermal insulation property of PVCT was improved. The polyester fabric can be replaced with a better performing fabric, such as polyamide, that generally has a longer lifetime, has a higher mechanical stability, and is light-weight. A facile method was introduced to make a same-polymer coated-textile composite out of polyamide through the partial dissolution of the fabric's surface followed by coagulation. The all-polyamide composite coated-textile (APCT) is mechanically stronger and more thermally stable than the PVCT and also weighs less. Additionally, the APCT is fully recyclable as it contains only a single component. This property can be beneficial for the recyclability and cost-effectiveness of the material. A new solvent for polyamides to prepare the APCT was proposed. A theoretical solvent selection method based on the Hansen solubility parameters was also introduced. The APCT can be used in the construction of textile bioreactors as well as other applications that require gas-/water-tightness and flexibility at the same time.

The outcomes of this research can increase the economic efficiency of the biofuel production process by decreasing the initial investment. From a technical perspective, the methods introduced in this thesis can encourage researchers in related fields to produce same-polymer composites and find/replace solvent(s) in a more efficient way.

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All-polyamide composite for the construction of bioreactors

UNIVERSITY OF BORÅS