Important notes:

Do **NOT** write outside the grey boxes. Any text or images outside the boxes **will** be deleted.

Do **NOT** alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.

Title:

Catalytic Membrane Reactor for Conversion of Biomass Feedstocks to Levulinic Acid

Authors & affiliations:

Zhexi Zhu[1], S. R. Wickramasinghe[2,3], N. Cao[3], X. Qian[1,3],
[1]Department of Biomedical Engineering, University of Arkansas, USA; [2]Ralph E Martin Department of Chemical Engineering, University of Arkansas, USA; [3]SIEV Technologies LLC, USA

Abstract:

Global warming due to release of greenhouse gases coupled with increasing world energy demands requires immediate development of renewable resources for production of fuels and chemicals. Though many technologies exist to convert biomass feedstocks to fuels and value-added products, commercialization has been slow. The high cost of production of biobased chemicals and fuels frequently makes them uncompetitive compared to fossil fuel derived products. Here a patented catalytic membrane reactor has been developed that can convert a variety of lignocellulosic biomass feed stocks (corn stover, corn fiber, wheat straw, almond and walnut shells, coffee ground, rice husks etc.) to levulinic acid with high yield and high selectivity. Levulinic acid is considered a critical platform chemical for the production of numerous chemicals, resins, fibers etc as well as the intermediate to aviation fuels. Today levulinic acid is largely produced from fossil fuels. The levulinic acid market is valued at over $27 billion annually.

Our catalytic membrane converter has a ceramic membrane substrate immobilized with a dual functional catalyst by grafting polystyrene sulfonic acid (PSSA) and polyvinyl imidazolium chloride (polyionic liquid, PIL) chains from the surface of the membrane. The grafting is shown schematically in Figure 1. The PSSA chains catalyze biomass hydrolysis and the subsequent conversion to levulinic acid. The neighbouring (PIL) chains help solubilize lignocellulosic biomass and enhance the catalytic activity of the PSSA chains. The PSSA chains were synthesized *via* surface-initiated atom-transfer radical polymerization whereas the adjacent PIL chains were synthesized *via* UV-initiated free radical polymerization.

Our results indicate up to 80% of levulinic acid can be obtained from almond hulls without any pretreatment. Moreover, over 90% yield can be reached from almond shells. The results are shown in Figure 2.

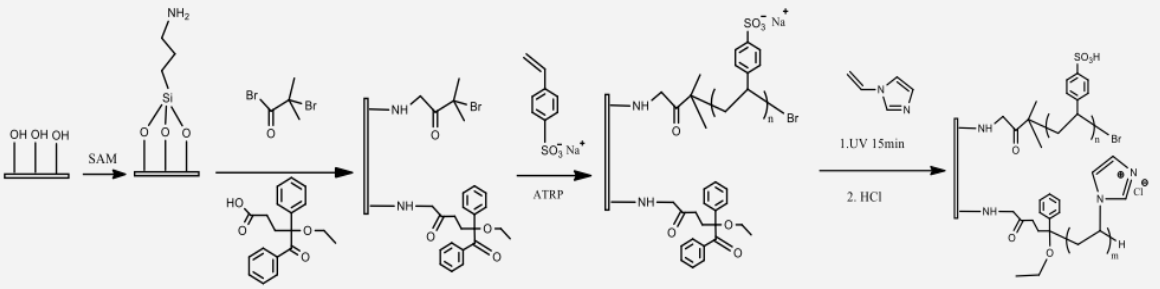

Figure 1 Schematic representation of membrane modification process.

Important notes:

Do **NOT** write outside the grey boxes. Any text or images outside the boxes **will** be deleted.

Do **NOT** alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.

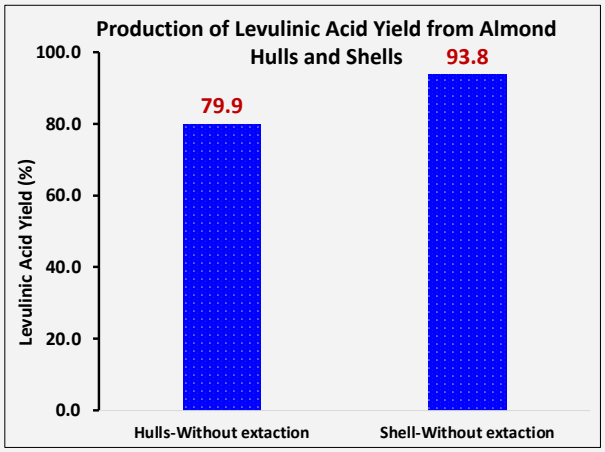

Figure 2 The conversion of almond shells and hulls to levulinic acid using SIEV's catalytic converter

Important notes:

Do **NOT** write outside the grey boxes. Any text or images outside the boxes **will** be deleted.

Do **NOT** alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.