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GREEN PRODUCTION OF BIOETHANOL USING SOLAR STEAM GENERATED WITH NANOPARTICLES

**Oara Neumann^{1,2}, Albert D Neumann¹,
Shu Tian^{1,2}, Christyn, Thibodeaux^{1,2}, Shobhit
Shubhankar¹, Julius Müller¹, Edgar Silva¹,
Alessandro Alabastri^{1,2}, Sandra W Bishnoi^{1,2},
Peter Nordlander^{1,2}, and Naomi J Halas^{1,2}**

¹Rice University, USA²Smalley-Curl Institute-Rice University, USA

Conventional bioethanol for transportation fuel typically consumes agricultural feedstock, also suitable for human consumption and requires large amounts of energy for conversion of feedstock to fuel. Alternative feedstocks, optimally those not also in demand for human consumption, and off-grid energy sources for processing, would both contribute in making bioethanol far more sustainable than current practices. Cellulosic bioethanol production involves three steps: the extraction of sugars from cellulosic feedstock, the fermentation of sugars to produce ethanol, and the purification of ethanol through distillation. Traditional production methods for extraction and distillation are energy intensive and therefore costly, limiting the advancement of this approach. Here, we report an initial demonstration of the conversion of cellulosic feedstock into ethanol by completely off-grid solar processing steps. Our approach is based on nanoparticle-enabled solar steam generation, where high-efficiency steam can be produced by illuminating light-absorbing nanoparticles dispersed in H₂O with sunlight. We used solar-generated steam to successfully hydrolyse feedstock into sugars, and then used solar steam distillation to purify ethanol in the final processing step. Coastal hay, a grass grown for livestock feed across the southern U S, and sugar cane as a control, are successfully converted to ethanol in this proof-of-concept study. This entirely off-grid solar production method has the potential to realize the long-dreamed-of goal of sustainable cellulosic bioethanol production

Biography

Oara Neumann is the J Evans Atwell-Welch Research Scientist at Rice University (a fully funded, endowed research scientist position at the university). She has completed her PhD and Postdoctoral study in Applied Physics at Rice University, MSc in Chemical Physics from Weizmann Institute of Science, Israel and another MSc in Analytical Chemistry from Bucharest University, Romania. She is the Pioneer of nanoparticle-based solar thermal applications. She holds several patents; she has published more than 25 refereed articles and has an h-index of 16.

Oara.Neumann@rice.edu