Laurence Weatherley

Albert P Learned Distinguished Professor
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Laurence Weatherley received his PhD from the University of Cambridge in Chemical Engineering for research on ion exchange kinetics in macroporous resins. He has published over 250 research papers, articles, conference papers and other contributions. Dr Weatherley is a chartered professional engineer (UK), a Fellow of the Institution of Chemical Engineers, United Kingdom, and a Fellow of the Institution of Professional Engineers of New Zealand. He also holds a visiting Professorship at the Lodz University of Technology, Poland. Dr Weatherley sits on the editorial boards of the following international journals: Recent Innovations in Chemical Engineering, Chemical Engineering and Processing, and the Chemical Engineering Journal. He was executive co-editor of the Chemical Engineering Journal for 10 years until 2010.

*Leading the Charge: Droplets and Interfaces for Intensive Chemical Processing***

The chemical industry in the United States contributes about 26% of national GDP and is involved in the production of 94% of all manufactured goods. 10% of all US energy use goes to separation of chemicals by distillation. So one of the major quests for chemical engineers is how can we intensify chemical separation processes and make them more efficient. Are there alternatives to distillation? The chemical and process industries worldwide include many different products and processes ranging from bulk hydrocarbon liquids, solvents, fertilizers, and polymers, through to highly sophisticated low-volume, high value products such as fibers, personal care products, pharmaceuticals, vaccines, antibiotics, anti-cancer compounds, high performance coatings, nuclear fuels, and electronic materials. A common theme for nearly all of these is a need for product separation and purification. This talk is about a separation and purification involving two non-miscible liquids and how these can be intensified. Process intensification is the development of small, highly efficient methods of processing which take up less space, use smaller amounts of hazardous chemicals, and are suited to the application of new "green" chemistry. In particular this lecture concerns how the disturbances observed at the boundary between the two liquids when an electrical field is applied across the boundary can contribute to process intensification. Enhanced rates of extraction and reaction occurring across or at the boundary are demonstrated thus providing an example of process intensification. In some cases rates can be up to ten times faster than if there is no electrical field involved. This lets us use much smaller equipment and less energy to process the same amount of material. I will provide an overview of why liquid-liquid processes are important industrially and then summarize our most recent research on electrically induced disturbances and mass transfer at a liquid-liquid interface. Results of visualization experiments to monitor electrically induced disturbances during mass transfer of ethanol from an aqueous phase into an extracting solvent, n-decanol, will be discussed. The presence of the DC electrical field is shown to have a positive effect on electrically induced interfacial turbulence and on mass transfer rate. The experimental data are successfully compared with simulations based on rigorous numerical solutions of the controlling equations. The visual disturbance pattern at the interface and rates of mass transfer are accurately predicted. The potential for electrically induced enhancement of other reaction systems involving liquid-liquid interfaces such as in the case of phase-transfer catalysis is highlighted.

** The lecture is an abridged version of a public lecture delivered at the University of Kansas on February 14th, 2017

Thursday, Sept 7th, 2017

2 Eaton Hall (Spahr Auditorium) 11:00 – 11:50AM