Characterization of Self-Assembled Nanostructures from Evaporated Drops of Bourbon Whiskey

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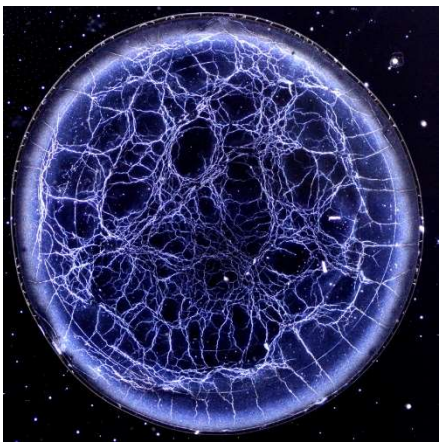
Abstract



A vibrant pattern of self-assembled microstructures appears when you evaporate a drop of diluted bourbon whiskey on a glass surface. For example, the shown figure is the resulting pattern of an evaporated 2.0 μL drop of Jack Daniel's Single Barrel diluted to 25% alcohol-by-volume. Over forty bourbons have been tested and each have resulted in this "whiskey web" pattern. Interestingly, each droplet appears to provide its own unique "fingerprint" and is influenced by the intrinsic properties of the bourbon (maturation, mash bill, etc.). Our group has investigated how these structures can be used for counterfeit identification. First, non-bourbon whiskeys (that we've tested to date) do not form this structure. Second, a custom image analysis program can determine if the web was altered by dilution. Last, digital images can be acquired using a smartphone. We believe structure formation is guided by microfluidic vortices induced by gradients in temperature and surface tension (Marangoni flows). Our group has used various characterization tools at the University of Louisville to gain insight into the structure and chemical composition of these microstructures. Results suggest that assemblies are derived from interactions of fatty acid micelles along with other solubilized constituents.

Biography of Presenter

Dr. Stuart J. Williams is an Associate Professor in the Department of Mechanical Engineering at the University of Louisville. He is a native of Louisville, graduated from the J.B. Speed School of Engineering (B.S, M.Eng. '05) before attending Purdue University (Ph.D. '09) under the support of the NSF Graduate Research Fellowship Program. Dr. Williams' ongoing research activities include the manipulation of colloids for their characterization and self-assembly. His work has been featured on the cover of various journals (*Electrophoresis*, *Lab on a Chip*, *Biotechnology & Bioengineering*). His current research is supported by NSF and NASA, the latter investigating colloid interactions under microgravity on the International Space Station.