Chemical Engineering of Foods

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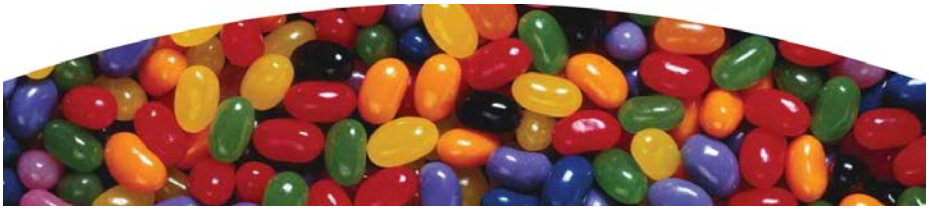
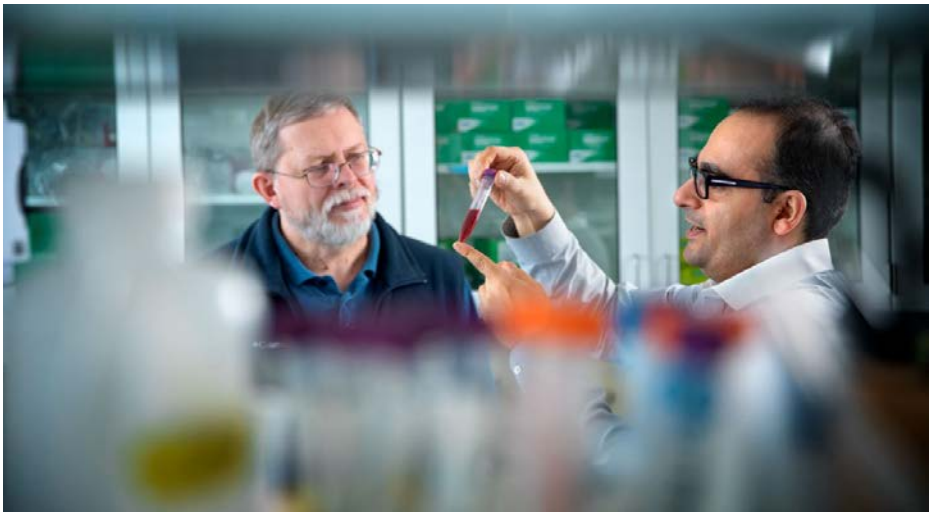


Common synthetic food colors in sweets

Food science offers a wealth of applications in physical chemistry and chemical engineering. Our main goal is to find out, whether and how natural polysaccharides - long polymer chains of sugar molecules - such as alginate and xanthan gum can stabilize natural food colors and vitamins [1]. Synthetic food colors are ubiquitous in food items that you find on a supermarket shelf. However, synthetic dyes such as Red 40 have been implicated in attention deficits and allergies in children [2]. Hence natural dyes such as berry juice or beet juice seem to be a healthier alternative. However, natural food colors have a tendency to denaturate and discolor - who would want to buy strawberry marmelade when it looks brown? We have recently found that polysaccharides can stabilize beet juice color significantly [3].



Detlef Smilgies (left) and Alireza Abbaspourrad (right) examining a beet juice sample (Source: Cornell Chronicle)

The goal of the project is to quantify how small molecules like dyes or vitamins interact with polysaccharides. In our initial studies whe have relied on quartz-crystal microbalance with dissipation (QCM-D) as our primary tool. In the project we would like to compare the information from QCM-D with isothermal titration calorimetry (ITC). While QCM-D weighs the amount of material that adsorbs on the quartz sensor, ITC works in the liquid phase and detects the tiny

amounts of thermal energy associated with the attachment of molecules and polymer. ITC experiments can be performed at the SUNY Pharmacy School at Johnson City in the Binghamton area. The local mentoring will be done by Detlef Smilgies (Binghamton University and Cornell) and Prof. Katie Edwards (SUNY Pharmacy School). QCM-D studies will be performed at the Cornell Food Science department in Stocking Hall under the supervision of Younas Dadmohammadi and Prof. Alireza Abbaspourrad. We will have a multitude of combinations to test and the specific materials for the project will be determined at the start of the project.

Suggested reading

[1] Cornell Chronicle 2/19: “We’ve got the beets: food consumers may see red - naturally” http://news.cornell.edu/stories/2019/02/weve-got-beets-food-consumers-may-see-red-naturally

Technical literature

[2] Food Standards Agency (UK): “Guidelines on approaches to the replacement of Tartrazine, Allura Red, Ponceau 4R, Quinoline Yellow, Sunset Yellow and Carmoisine in food and beverages”, https://www.reading.ac.uk/foodlaw/pdf/uk-11026-removing-colours-guidance.pdf

[3] Meghan Marchuk, Michael J Selig, Giovana B Celli, Peter Lawrence, Detlef-M Smilgies, Alireza Abbaspourrad: "Mechanistic investigation via QCM-D into the color stability imparted to betacyanins by the presence of food grade anionic polysaccharides", Food Hydrocolloids 93, 226-234 (2019). https://www.sciencedirect.com/science/article/pii/S0268005X18310051