Balloon drops and other shapes with miscible kitchen fluids

The kitchen is a hub of fluid mechanics where drops play a prominent role: the coffee ring effect, the transition from jetting to dripping in a tap, and the mesmerizing display of soap films during dish washing are everyday examples. These flows concern immiscible fluids and are well studied due to their omnipresence in technical situations such as inkjet printing and microfluidic encapsulation; however, transport problems involving miscible fluids have enjoyed far less attention, which is surprising given their rich dynamics. A canonical mixing problem from the kitchen concerns the sweetening of tea with honey, and we have previously shown (Walls et al., JFM, 2018) that sessile drops form miscible “skirts” due to free convection, and we report a remarkable jetting phenomenon for pendant drops. In this talk, we invert the fluids and look at freely suspended water drops rising through more dense, more viscous miscible liquids (Mossige et al., Phys. Fluids, 2021). We track the shape of these balloon shaped drops, as well as their velocities and volumes, and use a simple scaling relation to rationalize our findings. Our experiments make use of edible ingredients such as water, corn syrup and food coloring, and can be performed at home with simple kitchen tools and a cell phone camera. These types of kitchen flow experiments are vehicles for accessible and affordable science education and are hotspots for curiosity-driven research (Mathijssen, Lisicki, Prakash, Mossige, arxiv.org/abs/2201.12128, 2022).

Figure 1. Winnie the pooh rising through his favorite fluid.