A novel particle method for investigation of deformation properties of liquid marbles

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ABSTRACT

Liquid marbles are liquid droplets coated with super-hydrophobic particles. Liquid droplets are rolled on super-hydrophobic particle beds to form liquid marbles. Once the liquid marbles are formed the particle layer at the liquid-air interface completely separates the liquid from the surrounding environment. This particle layer is not rigid and deforms according to the shape of the liquid droplet. Therefore, the liquid marbles can be characterized using the elastic solid models, which contain liquid inside a soft solid membrane. Until recently, limited studies have been done to determine the variation of the stress with the strain of the liquid marbles. This paper presents a novel numerical modeling technique to predict the variation of the stress with the strain of the liquid marbles based on coarse grained molecular dynamics concepts. The model predictions are compared with the experimental results and it agrees well with the experimental findings. The experimental and numerical findings show that the variation of the stress with the strain of the liquid marbles is independent of the size of the liquid marble. Subsequently, the proposed liquid marble model is used to obtain the variation of the stress-strain curves with the density and the surface tension of the stress with the strain of the liquid marbles.

Key words: *liquid marbles, particle methods, coarse grained molecular dynamics, compression*