

Effects of Ultrasonication Time on Stability, Dynamic Viscosity, and Pumping Power Management of MWCNT-Water Nanofluid: An Experimental Study

Amin Asadi^{1,2*}, Ibrahim M. Alarifi^{3,4}

¹Institute of Research and Development, Duy Tan University, Da Nang 550000, Vietnam.

²Faculty of Natural Sciences, Duy Tan University, Da Nang 550000, Vietnam.

³Department of Mechanical and Industrial Engineering, College of Engineering, Majmaah University, Al-Majmaah 11952, Riyadh, Saudi Arabia

⁴Engineering and Applied Science Research Center, Majmaah University, Al-Majmaah 11952, Riyadh, Saudi Arabia

*Corresponding author: aminasadi@duytan.edu.vn

Supporting information:

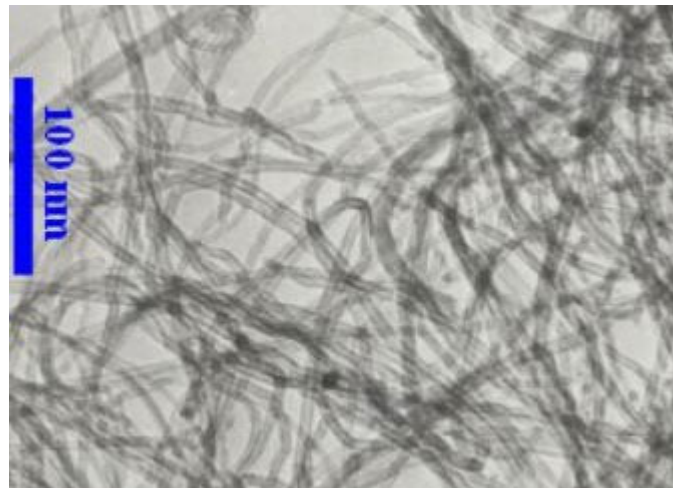


Fig. I. TEM image of MWCNT particles [55] (Reprinted with the permission of Elsevier).

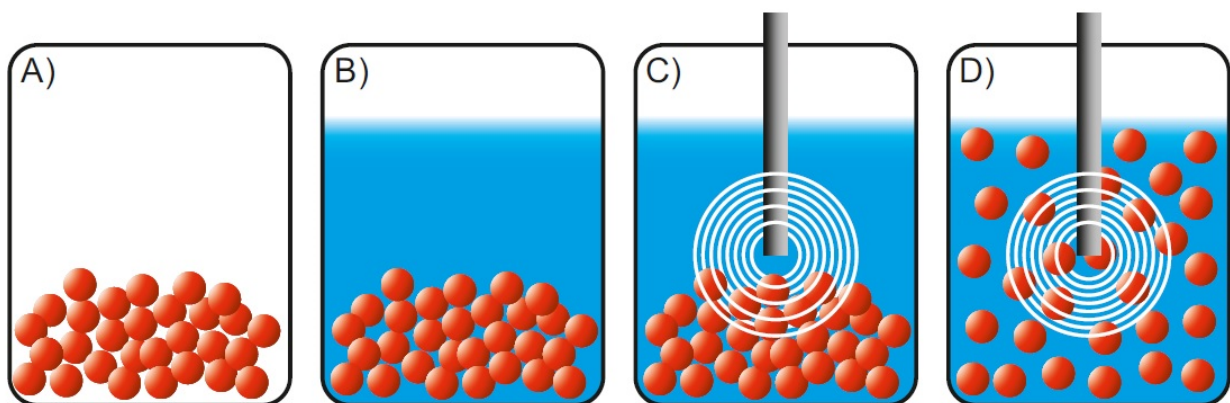
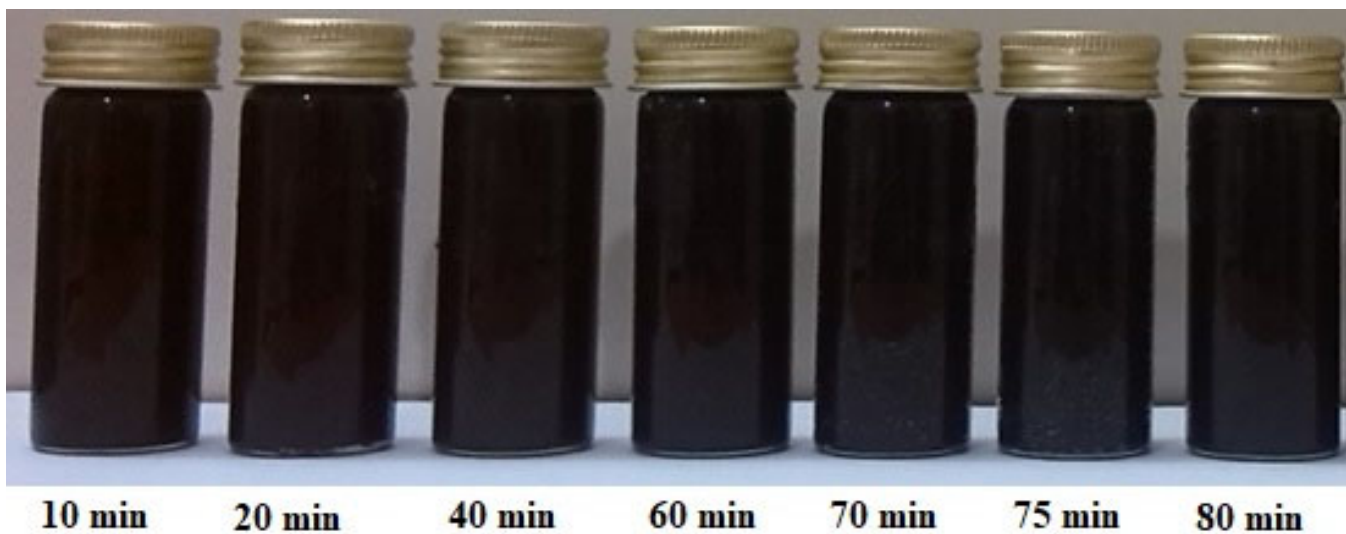
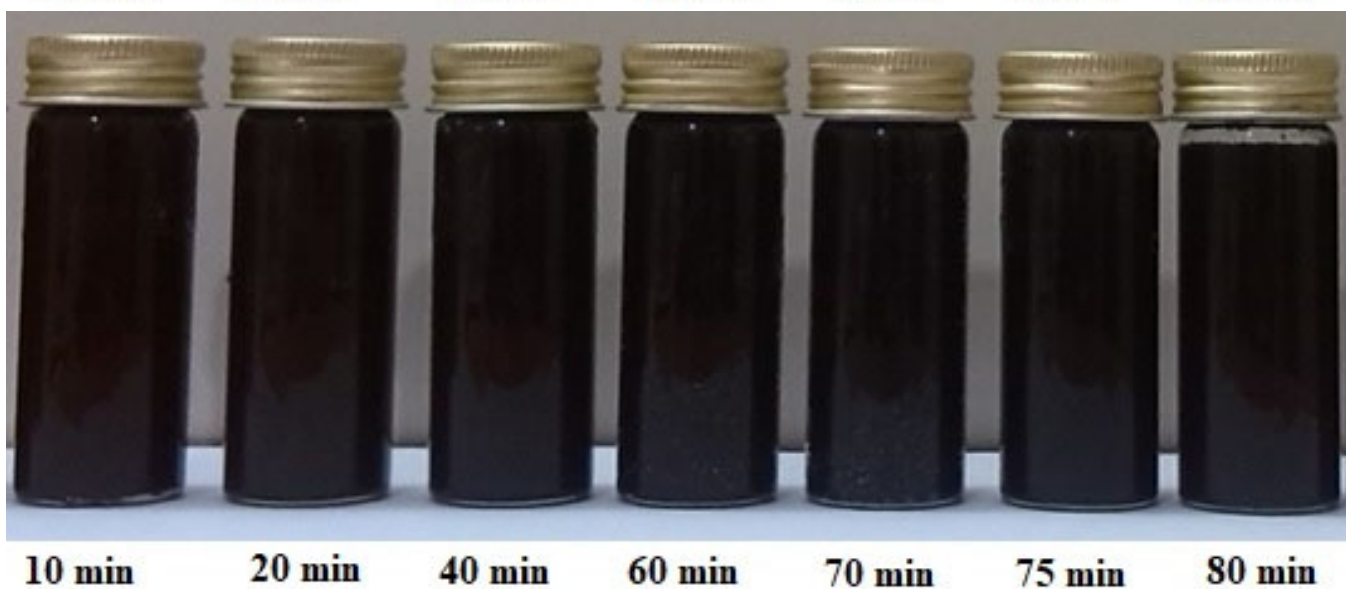


Fig. II. A schematic view of different stages of the two-step method [56] (Reprinted with the permission of Elsevier).

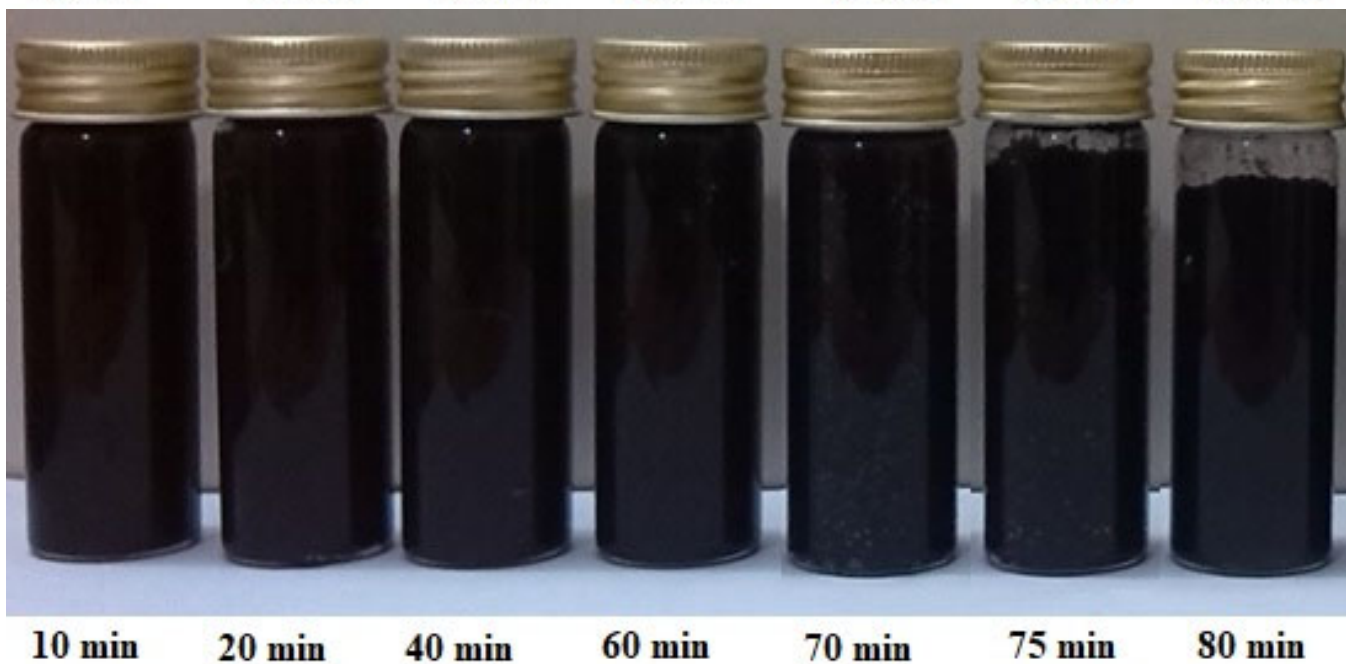
1st day



5th day



10th day



30th day



10 min 20 min 40 min 60 min 70 min 75 min 80min

Fig. III. Stability analysis of the NF samples through visual observation over 30 days after preparation [38]
(Reprinted with the permission of Elsevier).

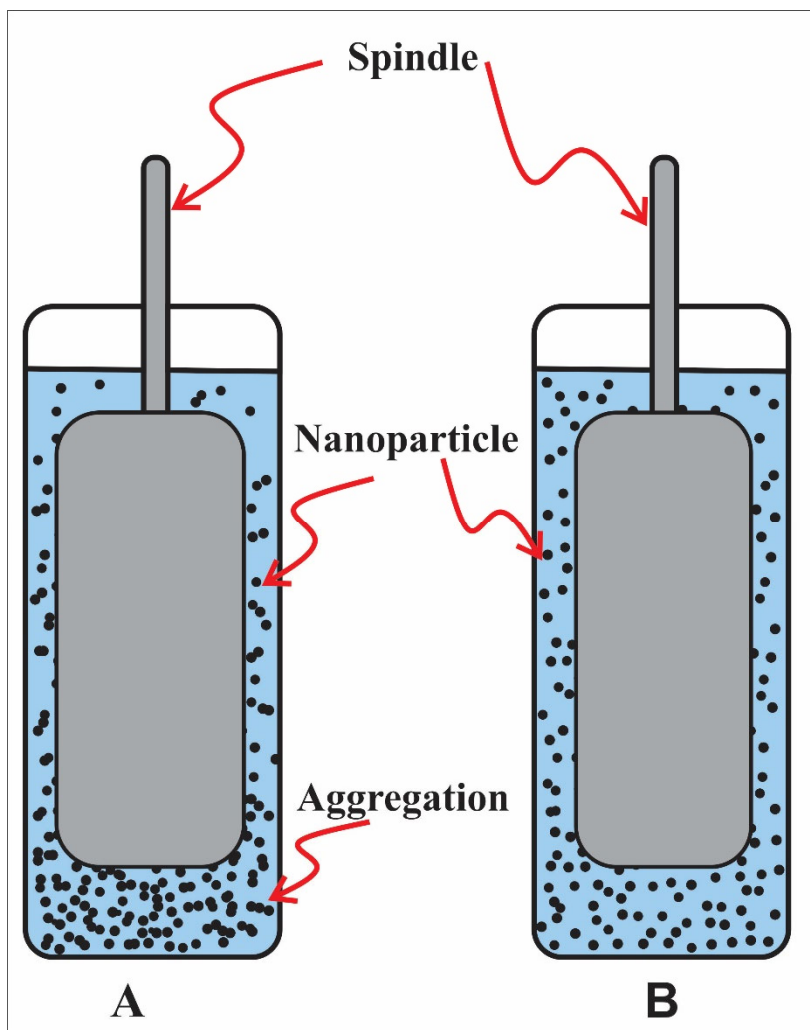


Fig. IV. A schematic view of the effect of ultrasonication on breaking down the cluster of particles and decreasing the viscosity; A) before ultrasonication, and B) after ultrasonication [36] (Reprinted with the permission of Elsevier).

Tab. I. Detailed information of MWCNT particles [55] (Reprinted with the permission of Elsevier).

Outside diameter	<7 nm
Inside diameter	2-5 nm
Length	10-30 μm
SSA	>500 m²/g
Electrical conductivity	>100 s/cm
True density	2.1 g/cm³
Purity	>95 wt %