

# CURRENT RESEARCH AND DEVELOPMENT IN BIOTECHNOLOGY ENGINEERING AT IIUM

VOLUME IV

Editors:

Ma'an Alkhatib  
Abdullah Al Mamun  
Faridah Yusof



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***(VOLUME IV)***

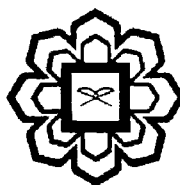
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**Ma'an Alkhatib**

**Abdullah Al Mamun**

**Faridah Yusof**

**Department of Biotechnology Engineering  
Faculty of Engineering  
International Islamic University Malaysia**



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### STABILITY OF DISPERSION OF SINGLE WALL CARBON NANOTUBES (SWNT)- CARBOXY METHYL CELLULOSE (CMC) IN AQUEOUS SOLUTION

Ahmad T. Jameel, Mohammed S. Jami and Syarifah R. Kamaruzaman

Department of Biotechnology Engineering, Faculty of Engineering, International Islamic University Malaysia, Gombak, 50728 Kuala Lumpur, Malaysia.

#### ABSTRACT

Nanofluid is a new engineering material consisting of nanometer sized particles dispersed in a base fluid. Single-walled carbon nanotubes (SWNT) are structurally unique materials that exhibit excellent mechanical, electrical, thermal and optical properties. A variety of chemical functionalization and physical methods have been used to achieve effective dispersion. SWNT pack into crystalline ropes that aggregate into tangled networks due to strong van der Waals attraction. Aggregation acts as an obstacle to most applications and diminishes the special properties of the individual tubes. In this study, SWNT has been used to produce nanofluid using distilled water as base fluid and carboxymethyl cellulose (CMC) as dispersant. The stability of nanofluid with sediment time was estimated by using UV-vis spectrophotometer. Stability of nanofluid was influenced by the concentrations of SWNT, CMC and sonication time. The best dispersion was obtained for 0.06 wt % SWNT, 0.1wt% CMC and 4 hour sonication time.

**Keywords:** nanofluid, single wall carbon nanotube, stable dispersion, CMC

#### INTRODUCTION

Nanotechnology is the science and technology of manipulating things at the atomic or molecular level to produce useful machines, materials or products. Modern nanotechnology can produce particles in nanometer dimensions. The example of these nanoparticles is carbon nanotubes (CNTs) which are tubular nanostructures where the graphite sheet was rolled into cylinder of nanosize tube. The special characteristic such as unique atomic structure, high aspect ratio, light weight, extraordinary mechanical properties and high thermal conductivity make carbon nanotubes a very attractive material to be used in nanotechnology applications. Single-walled carbon nanotubes (SWNT) have diameter in the range 0.3-1nm and multi-walled carbon nanotubes (MWNT) have diameter range up to few hundred nanometers.

In recent year, fluids containing suspension of nanometer sized particles (nanofluids) have been an active area of research due to their enhanced thermal properties over the base fluids. In a better description, nanofluids are engineered colloidal suspensions of nanoparticles (1-100 nm) in a base fluid. Common base fluids include water and organic liquids. Nanofluids are being investigated for numerous applications, including cooling, manufacturing, chemical and pharmaceutical processes, medical treatments and others. Therefore, the invention of nanofluids presents new opportunities and challenges for thermal scientists and engineers