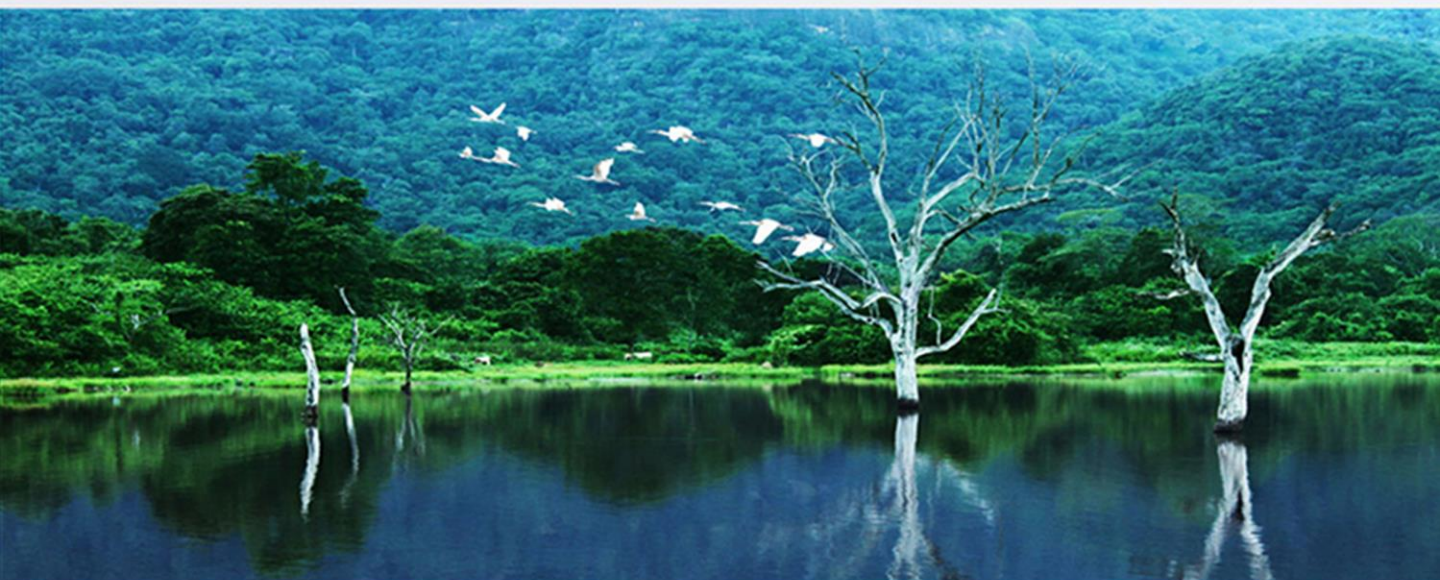




PROCEEDINGS INTERNATIONAL SYMPOSIUM ON WATER QUALITY AND HUMAN HEALTH CHALLENGES AHEAD



History Culture Ecosystems Biodiversity Sustainability Livelihood Services Leisure Future

All begins with water

Postgraduate Institute of Science (PGIS) University of Peradeniya - Sri Lanka
23rd & 24th August 2024

Organized by the

BOARD OF STUDY IN ENVIRONMENTAL SCIENCE
POSTGRADUATE INSTITUTE OF SCIENCE (PGIS)
UNIVERSITY OF PERADENIYA, SRI LANKA



PR16

**LINEAR MODEL APPROACH TO ANALYZE RADIAL ACCELERATION
EFFECTS OF MEMBRANE THICKNESS IN SPIN COATING**

S.P. Hemachandra^{1*}, S.M.L.M.B. Senarathne² and R. Weerasooriya¹

¹Centre for Water Quality Research, National Institute of Fundamental Studies, Kandy, Sri Lanka

²China-Sri Lanka Joint Research and Demonstration Centre for Water Technology, Peradeniya, Sri Lanka

Achieving the desired properties of the membrane fabrication using the spin coating method requires precise control of coating thickness. While a general equation exists for coating thickness based on angular velocity, the significant influence of radial velocity and radial acceleration of the rotor remains critical, especially considering the non-constant nature of radial velocity. The aim of this study was to develop a mathematical model that explains the relationship between film thickness and radial acceleration in spin coating, assuming constant angular velocity and other key parameters, such as temperature, pressure and solution concentration. Using MATLAB software, data on the acceleration, deceleration and spin time of the rotor measuring the coating thickness were entered as output. By plotting the radial velocity vs. rotation time, Equation (1) describing the relationship between the area under the curve and the radial acceleration (f) was obtained. Then, by integrating the area under the velocity-time curves for the radial velocity change, Equation (2) correlating the integrated area (x) to membrane thickness (y) was generated.

$$\text{area} = \left(\frac{6480000}{f} \right) + 113400 \quad (1)$$

$$y = 4.3573 \times 10^{-4} x + 9.8653 \quad (2)$$

Further analysis involves replacing the variable x (representing the integrated area) in Equation (2) with the expression derived from Equation (1), yielding the final linear equation (3) that correlates membrane coating thickness (h) directly to radial acceleration (f). This new approach bridges the gap between process parameters and membrane properties, providing valuable insights for optimizing membrane fabrication processes.

$$h = \frac{2823.5}{f} + 59.2771 \quad (3)$$

Financial assistance from the National Research Council of Sri Lanka (Grant No. NRC TO 16-015) is acknowledged.

Keywords: MATLAB, membrane modeling, membrane technology, spin coating method, water desalination

*samadhi.he@nifs.ac.lk