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# Radiotracer Investigation Of The Effect Of Impeller Type On Mixing In Industrial Process Simulator

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S.Y. Adzaklo,* C.P.K. Dagadu, I.I. Mumuni, P.S. Adu, H.A. Affum, G.K. Appiah,
A. Coleman

National Nuclear Research Institute, Ghana Atomic Energy Commission, P. O. Box LG 80, Legon-Accra
*s.yadzaklo@gaecgh.org

Abstract

Radiotracer technology has been applied in the industry for the investigation of process performance, online monitoring of conditions of process plants, troubleshooting and diagnosing anomalies including mixing conditions in continuous stirred tank reactors.

In this study, radiotracer methodology was used to carry out investigation on a laboratory water flow rig which serves as simulator of industrial processes. The aims of the investigation were to assess: i) the effect of impeller type on mixing, and ii) the fluid dynamics of the water in the vessels since both the vessels and the impellers were redesigned and reconstructed. Four similar vessels in series circuit with different impeller configurations were investigated. Tank 1 has 1 axial impeller, tank 2 has 2 axial impellers, tank 3 has 2 radial impellers and tank 4 has no impeller. The data was collected by introducing 8 mCi liquid $^{99m}$Tc at the inlet stream of the vessels and the $\gamma$-signal was collected with thallium activated NaI detector placed at the outlet of the vessels. Residence time distribution (RTD) curves for the outlet tracer concentration were generated from which the mean residence time (MRT) and variance were calculated by the method of moments. The extent of material mixing in the vessels was inferred from the variances and the fluid dynamics was obtained by modelling.

The extent of mixing was highest in tank 3 followed by tank 1, and tank 4 gave the poorest mixing. The outlet response curves were fitted with mathematical models using DTS pro and RTD Software. The best fit for tanks 2, 3 and 4 was perfect mixers in series with exchange (PMSE) model while perfect mixers in series with recycle (PMSR) model best described the fluid dynamics of the material in tank 1.

## Country/Organization invited to participate

Ghana

**Primary author:**   Mr ADZAKLO, Simon Yao (Ghana Atomic Energy Commission, Ghana)

**Co-authors:**   Mr DAGADU, Christian P. K. (Ghana Atomic Energy Commission, Ghana);  Mr MUMUNI, Ishmael (Ghana Atomic Energy Commission, Ghana)

**Presenter:**   Mr MUMUNI, Ishmael (Ghana Atomic Energy Commission, Ghana)

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