Reconstruction algorithm of calibration map for RPT technique in quadrilateral bubble column reactor using MCNPX code

ABSTRACT

Radioactive Particle Tracking (RPT) is non-invasive evaluation technique capable of visualising and tracking the motion of the identified phase in bubble column reactor. The single radioactive particle emits γ-ray, and its movement in the column is tracked with the aid of arrays radiation detectors. In this study, Monte Carlo approach was programmed to reconstruct the particle tracer position so-called calibration map. The iterative reconstruction algorithms is used to generate and calculate the 2600 coordinates of calibration map from the number of photon counts from the ten NaI scintillation detectors. To validate the simulation precision, a spiral trajectory of radioactive particle inside the bubble column region consist of 84 grid point locations of the particle were applied. Calibration algorithm was developed for radioactive isotopes Au-198 and Sc-46 particle position verification and determination of statistical uncertainty from the introduction of a various number of primary photon emission. The result of the studies proved that higher number of particles used in the algorithm for position reconstruction gives more accuracy and we found that the Sc-46 obtain more accurate calculation and shows low statistical level than Au-198 particle. The outcome of this simulation based on random sampling from Monte Carlo N-Particle Extended (MCNPX) demonstrated that the calibration map could successfully be implemented in RPT technique to observe the dynamic movement of radioactive particle which represents the tracked media in the quadrilateral bubble column.