The study was undertaken to assess the performance of various recent nitrogen removal techniques, namely, anammox and CANON processes. Studies on nitrogen removal techniques were carried out in column type sequencing batch reactor systems having numerous advantages over conventional biological reactor systems. Formation of aerobic granules is a key factor in the performance of column type SBRs. Initial studies were carried out to evaluate the optimum height to diameter ratio for the development of aerobic granules. Aerobic granules were successfully developed on synthetic media. Granulation process was best observed (granule size 3-5mm) at H/D ratio of 20. Granules formed had excellent settling properties.

The conventional biological nitrogen removal process, namely, autotrophic nitrification and heterotrophic denitrification, require significant energy and external carbon source. To overcome these drawbacks recent processes of nitrogen removal including anammox process and CANON process have gained popularity. However, these processes are still to be successfully used for nitrogen rich industrial wastewaters. Studies were performed for the enrichment of anammox microorganisms and its subsequent application for the treatment of nitrogen rich wastewaters. Studies were also performed to evaluate the performance of aerobic granules for the treatment of nitrogen rich slaughterhouse wastewater.

Digester sludge effluent was successfully treated for nitrogen and COD removal by CANON process in column type sequencing batch reactor. When raw digester effluent was fed to the reactor, with TKN (795 mg/L), Ammonium (564 mg/L and COD (1365 mg/L) the highest removal efficiencies for TKN, Ammonium and COD achieved were 90%, 98% and 91% respectively. The concentrations of TKN, Ammonium and COD in the treated effluent were within permissible limits.

Landfill leachate was successfully treated for Nitrogen and COD removal but only upto 20% leachate concentration. At this fraction the characteristics of diluted leachate were as follows: TKN (665mg/L), Ammonium (220 mg/L) and COD (1152 mg/L). The highest removal efficiency achieved were 78%, 98% and 73% for TKN, Ammonium and COD respectively. The concentration of TKN and ammonium were under
permissible limits in treated effluent. However, the value of COD has slightly above permissible limits necessitating further treatment of effluent. The effluent was then subjected to Advance oxidation treatment by ozone and fenton’s reagent. After treatment with ozone the overall COD removal efficiency achieved was 85% at ozone exposure time 30 minutes. The COD removal efficiency using fenton’s reagent the was 81% at 6 ml of hydrogen peroxide dose.

The SBR seeded with aerobic granules was used for the treatment of nitrogen rich slaughter house wastewater. The results of the study showed almost complete Nitrogen and COD removal. The raw slaughter house wastewater having TKN (1165mg/L), Ammonium (975 mg/L) and COD (5230 mg/L) was successfully treated with the highest removal efficiencies achieved were 96%, 98% and 98% respectively.

Column type sequencing batch reactor was used in the studies performed for treatment of different industrial effluents, as it was easy to operate, require less space and short start up time as compare other reactor configurations.

The results of the studies performed for the treatment of sludge digester effluent, land fill lechate and slaughter house wastewater showed that aerobic granules can handle high-strength industrial wastewaters containing high organics and nitrogen that cannot be treated by Canon processes.

Aerobic granular sludge technology is the best available technology that can be applied for simultaneous organics and nitrogen removal.

With further research on aerobic granular sludge technology, full scale STP and Industrial effluent treatment plant based on this technology may be implemented in India with less capital investment and less area requirement as compare to conventional activated sludge process.