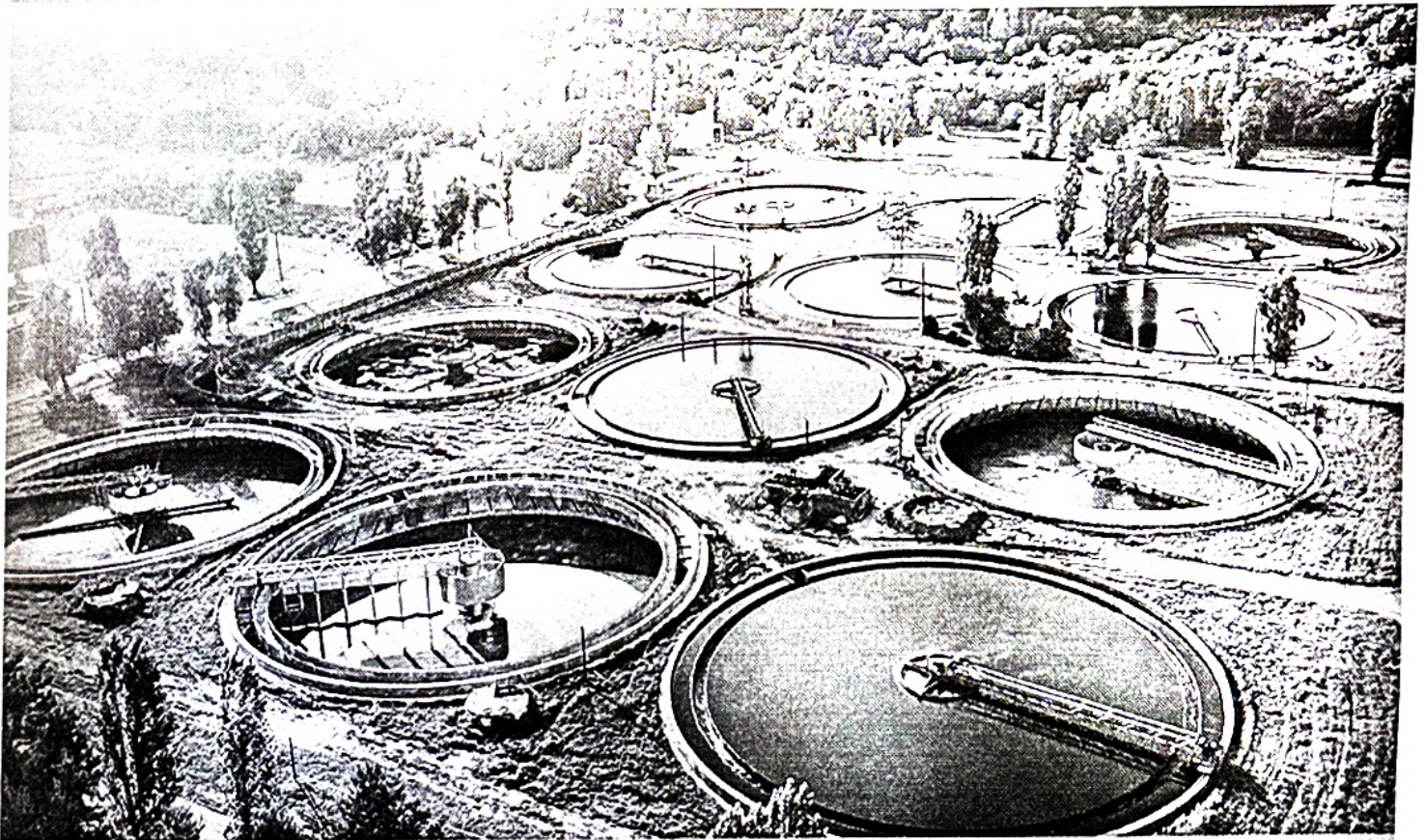


Resource Recovery in MUNICIPAL WASTE WATERS



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Nitrogenous fuels recovery from municipal wastewater treatment plants

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Abbreviations

ADP	Adenosine Diphosphate
AOB	Ammonia-oxidizing bacteria
ATP	Adenosine Triphosphate
C	Carbon
Ca ²⁺	Calcium ion
CH ₃ COO ⁻	Acetate
CO ₂	Carbon Dioxide
DO	Dissolved oxygen
e ⁻	Electron
EPS	Extracellular polymeric substance
FAB	Freshwater anammox
FBBR	Fixed bed biofilm reactors
H ⁺	Hydrogen ion
H ₂ O	Water
HCO ₃ ⁻	Bicarbonate ion
K ⁺	Potassium ion
MAB	Marine anammox bacteria
MBBR	Moving bed biofilm reactors
Mg ²⁺	Magnesium ion
MgNH ₄ PO ₄ ·6H ₂ O	Magnesium ammonium phosphate hexahydrate
N	Nitrogen
N ₂ H ₄	Hydrazine
N ₂ O	Nitrous oxide
Na ⁺	Sodium ion
Na ₃ PO ₄ ·12H ₂ O	Sodium Phosphate Dodecahydrate
NaCl	Sodium Chloride
NH ₃	Ammonia

NH_4^+	Ammonium ion
NO	Nitric Oxide
NO_2^-	Nitrite
NO_3^-	Nitrate
NOB	Nitrite-oxidizing bacteria
O_2	Oxygen
O_3	Ozone
PN	Partial nitrification
PO_4^{3-}	Phosphate
QS	Quorum sensing
ROC	Reverse osmosis concentrates
SBBR	Sequencing batch reactors
TN	Total nitrogen
WWTPs	Municipal wastewater treatment plants

11.1 Introduction

Overpopulation, rapid industrialization, and affluent lifestyles necessitate a significant amount of usable and nonusable water, but the current trending lifestyle results in freshwater scarcity. Wastewater recycling and reuse are required due to the rising imbalance between freshwater supply and demand by all living species. Because of increased population and industrialization, the requirement for nitrogen and phosphorus will grow because nitrogen and phosphorus play critical roles in plant growth and food supply (Sengupta et al., 2015). As a result, proper wastewater treatment is required for wastewater that enters the aquatic ecosystem as a result of anthropogenic activities in the rural and urban sectors. Polyaromatic hydrocarbons, sulfonamides, ammonia, polychlorobiphenyls, pyridine, nitrogenous wastes, and phosphates are among the pollutants that degrade the quality of water bodies.

Nitrogen is a significant nutrient found in wastewater in a variety of forms. In wastewater, the different forms of nitrogen are ammonia (NH_3 as a gas or NH_4^+ ions), nitrite (NO_2^-), nitrate (NO_3^-), and organic nitrogen (urea, fecal material) (Crites et al., 2006). Ammonia is the world's second most abundant synthetic inorganic commodity. Moreover, various ammonia-derived nitrogen-based fuels have been proposed, namely ammonium nitrate-based compositions (Izato et al., 2013), aqueous hydroxyl ammonium nitrate, ammonium dinitramide (Fujisato et al., 2014), and aqueous ammonium nitrate with ammonium hydroxide or urea. Among these nitrogen-based fuels, ammonia is the simplest one (Johnston, 2005). The concentration of total nitrogen (TN) ranges from 15 to over 50 mg/L in atypical municipal wastewater. The release of nitrogen into surface water reduces the oxygen concentration in water. In the United States, around 12 million tonnes of nitrogen (N) are used as fertilizer each year, resulting in severe nutrient pollution of surface waters via surface wastewater discharge and surface runoff.