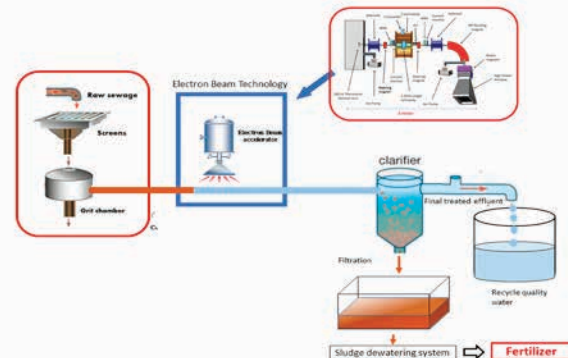


## Superconducting High-Intensity Electron Accelerator for Wastewater Treatment



**Problem Statement:** Providing clean and safe water is one of the sustainable development goals. However, the pressing needs of agricultural and industrial demands have reduced the freshwater quality and increased the contaminants over the decades. Simple treatment methods are insufficient as the wastewater contains human waste, industrial sewage, and pathogens. The Contaminants of Emerging Concern (CEC), especially pathogens, show resistance, rendering the earlier treatments ineffective. Recently, studies have demonstrated that ionising radiation such as electron beams could effectively treat CECs and remove pathogenic microorganisms. This research proposes to develop a superconducting compact high-intensity electron accelerator for treating domestic and industrial effluents.

**Uniqueness of the Solution:** Electron Beam Technology (EBT) works at the molecular level. Highly energetic electrons incident on water excite atoms by

stripping their electrons or breaking the chemical bonds between molecules. Thus generated ions can carry out oxidation and reduction reactions simultaneously and destroy the organic and inorganic compounds within one  $\mu\text{sec}$ . The technology requires no chemicals, and the need for lengthy exposure time is also eliminated. The electron beam irradiation process is the only process capable of forming highly oxidising and reducing reactive species and generating a high yield of ions per unit energy than any other conventional process. In addition, unlike the conventional STPs, the system is compact, and the sludge can be used as fertiliser.

**Current Status of Technology:** The proposed system is validated in the KEK, Japan, the foremost high-energy physics laboratory in the world. Expertise at KEK will be used to design and establish the technology used for water purification and many other applications.

**Societal Impact:** The technology will help solve the water crisis; it can also be used to irradiate food grains and fruits (to improve shelf-life), disinfect hospital wastes and cargo scanning.

**Patent(s):** Nil

**Relevant Industries:** Superconducting High-Intensity Electron Accelerator and Waste-water Treatment, Environmental Technology.

**Faculty:** Prof. Raghava Varma, Physics.