Application of gamma irradiation in recycling and inactivation of pathogenic microorganisms of municipal sewage sludge in South of Tehran for production of soil organic fertilizer

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Abstract

Sewage sludge is an inevitable byproduct of wastewater treatment plants and an important source of essential plant nutrients and with inactivation of its pathogenic microorganisms by gamma radiation can be recycled as soil organic fertilizer. The main objective of this research is to evaluate the sludge treatment by gamma irradiation with/without pasteurization on the removal of main indicators pathogenic in the South of Tehran waste water treatment plant sludge (WWPTs). The bacterial indicators of such as Fecal Coliform, Staphylococcus, Salmonella, Escherichia (E. coli) were examined with gamma irradiation (0, 5, 10, 15, 20 kGy), pasteurization (70 and 180 °C) and their combination. The count of some pathogenic bacteria was more than the standard and limited in its use as organic fertilizer, until they were not placed in class B and P3 according to the American standard and the Iranian standard (respectively). Application of gamma irradiation at least 10 kGy dose, alone, and combination of gamma irradiation (at least 10 kGy) and pasteurization were sufficient for complete inactivation of four pathogenic bacteria indicators, however, the pasteurization methods alone were not able for removal them, completely. Generally, gamma irradiation of sewage sludge to produce organic soil fertilizer singly is in accordance with national and international standards and is sufficient and cost-effective compared to the combination of two methods.

Keywords: Gamma Irradiation, Recycling Sewage sludge, Pathogenic microorganisms, Soil Organic Fertilizer, South of Tehran waste water treatment plant