MODELING OF A HETEROGENEOUS SUPERCRITICAL OXIDATION REACTOR

F.Mancini[1,2], F.Cansell[1], F.Marias[2], J.Mercadier[2]

1. Institut de chimie de la Matière Condensée de Bordeaux (ICMCB)
87, avenue du Dr Schweitzer, 33 608 PESSAC Cédex, France

2. Laboratoire de thermique, Energétique et Procédés-EA 1932
Rue J.Ferry, 64 000 PAU, France

ABSTRACT

Hydrothermal oxidation is an efficient and clean way for the transformation of wastewater containing organic compounds. So-called hydrothermal oxidation, these processes will be called subcritical oxidation or supercritical operation depending upon pressure and temperature conditions. The main advantage of these processes is that by-products are non-toxic. Indeed, organic material (C,H,O) is exclusively converted into carbon dioxide and water. These processes are particularly suitable for the treatment of wastewater too concentrated for biological treatment or too wet for incineration treatment.

The purpose of this work is to develop a mathematical model for a new reactor concept for hydrothermal oxidation, in order to treat aqueous waste loaded with solid particles. Indeed, until now, the reactive system has always been considered as monophasic. The presence of consumables solid particles requires taking into account both reaction at the surface of the particle and heat and mass transfer to the surface of that particle.

.

The mathematical model is based on stirred tank reactor. The governing equations are: mass, species, energy and population balances. Thanks to this model, the temperature, size distribution of solid particle, concentration of waste and oxidant are computed. These numerical predictions are used to scale up a pilot, which is able to treat 1 kg per hour of aqueous wastes loaded with solid particles at a pressure of 25 MPa and an inlet temperature of 250°C.