Comparative Genetic Activity of Samples Collected from Two Different Urban Waste Incinerators

R. Vellosi, A. Galli, F. Rossi, E. Morichetti, and G. Bronzetti

Institute of Mutagenesis and Differentiation, C.N.R., Via Svezia 10, 56100–Pisa, Italy

Incineration of industrial and urban waste materials is an important problem for the environmental contamination and therefore for human health. Environmental contaminants spread by urban incinerators can contain a complex mixture of toxic compounds such as dioxin, benzofurans, alogenate acids (Olie et al., 1977). These compounds may interact in a synergistic or antagonistic way with regard to their biological effects. For this reason it is important to evaluate the genetic damage induced by complex mixtures widespread in the environment. Short-term tests provide important information on the carcinogenic potential of such substances.

In the present work, the genotoxic activity of samples obtained from the urban incinerator of Florence was analyzed. The results were compared with those obtained with samples drawn from the urban Snamprogetti incinerator of Schio (Vicenza), where halogenated acids contained in the smoke are neutralized with lime wash in a salification column.

Samples were tested using prokaryotic (Salmonella typhimurium TA98, TA100 and TA102 strains) and eukaryotic (Saccharomyces cerevisiae, D7 strain) microorganisms. These systems permit one to obtain rapid, reproducible and reliable results in order to evaluate the genotoxic activity of substances present in the environment (McCann et al., 1975).

Send reprint requests to Rita Vellosi, Istituto di Mutagenesi e Differenzimento CNR, Via Svezia 10, 56100–Pisa.
MATERIALS AND METHODS

Samples drawn from two urban waste incinerator are: cinders, fly ash, dusts from an electrostatic separator and condensate smokes. Condensate smokes from the Schio incinerator are mixtures of 16 samples drawn upstream and downstream of the salification column (Fig.1 and Fig.2). Solid samples were extracted in Soxhlet apparatus for 24 hours in 100 ml of Toluene. The extract was then evaporated with a rotary evaporator and the residue taken up in 10 ml of dimethylsulfoxide (DMSO) (Commoner et al., 1978). Each extract was tested for genotoxic activity.

Mutagenesis testing was performed using the *Salmonella typhimurium* TA98, TA100 and TA102 strains, obtained from Dr. B.N.Ames. The samples were tested according to the standard methods described by Ames (Ames et al., 1975). The diploid D7 strain of *Saccharomyces cerevisiae* obtained from F.K. Zimmermann was used to determine the frequency of mitotic gene conversion at the trp5 locus and point reverse mutation at ilv1 locus (Zimmermann et al., 1975). Since the samples were dissolved in DMSO, all the negative controls were performed in the presence of an equal volume of DMSO.

S9 hepatic fraction for metabolic activation was prepared following the standard procedure as previously described (Bronzetti et al., 1983). Protein concentration of the S9 fraction (32 mg/ml) was determined according to Lowry, as reported by Bailey (1967). S9 mix concentration used in the Salmonella plate test corresponded to 1,6 mg total protein/plate. S9 concentration in yeast test was 8 mg/ml total protein of incubation mixture. Data obtained were submitted to the Student's 't' test with computer assistance.

RESULTS AND DISCUSSION

Table 1 and 2 show the number of *S.typhimurium* revertants/plate following treatment with condensate smokes, fly ash and dust of electrostatic separator. A significant increase of TA98 revertant number following treatment with fly ash and dust of electrostatic separator extracts in the presence of S9 mix was observed only for the samples collected from the