Root Elongation Assay

The variety of toxic substances generated by different human activities (industrial, urban and agricultural), that can potentially contaminate and to be harmful to the environment are innumerable and cannot be assessed by physical chemical parameters. The essays using quality bioindicator organisms are one of the tools to be used to complement the toxicity assessment of environmental samples. The phytotoxicity tests based on seed germination and root elongation has also been conducted to assess the potential contamination of solid waste and effluents to be used in the environment, for agricultural purposes.

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SÃO PAULO
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POLLUTION BIOMONITORING WITH PLANTS

SOIL AND GROUNDWATER QUALITY

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ENVIRONMENTAL QUALITY

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SOIL AND GROUNDWATER

The Soil and Groundwater Section-EQAA is responsible for the coordination of projects and all related work on soil and groundwater quality evaluation of the State of Sao Paulo (SP), Brazil. The EQAA section also conducts the biomonitoring of air pollutants of interest, with plants.

The use of bioindicators in the air pollution monitoring

Since the 1990s, CETESB has been conducting studies on the effects of air pollution in vegetation and on the investigation of species that can be used as air quality bioindicators, either in the active biomonitoring, or in the passive biomonitoring.

The passive biomonitoring uses the existing species at the local of interest (that can be a punctual spot or also its surroundings, depending on the preferential wind direction, spatial distribution, etc.). The active biomonitoring is a standardized essay, using plants which are able to be a bioindicator, that are exposed at the local of interest, in a specific period of time.

Gaseous Fluorides

Gaseous fluorides, considered highly phytotoxic, had been studied by develop countries. In Brazil, specifically at Cubatão, a essentially industrial city, near the coastal region. This air contaminant was considered one of the major causes of the vegetation degradation at Serra do Mar, an important protected area, belonging to the southeast Rain Forest, specifically at a location called Vale de Moji. This area concentrates atmospheric emissions from industries, mostly fertilizers industries, aluminium, and glass and ceramic industries.

The assessment of the potential phytotoxicity of this pollutant can be conducted by the active biomonitoring, with the use of *Cordyline terminalis* (dracena), or by the passive biomonitoring, with the sampling of representative native species of the region. The foliar samples are evaluated firstly by the examination of visible foliar injuries, and thereafter, sent to laboratory for the determination of fluoride mass concentration.

The specie *Cordyline terminalis* (dracena) is very sensitive to pollutants, and also easily to be kept for experiments and to be reproduced and spread in greenhouses by cutting.

Ozone

Similarly, a variety of tobacco, known scientifically as *Nicotiana tabacum* Bel W, has been studied for decades in Europe and in United States, as a specific bioindicator for photooxidants compounds, mainly the atmospheric ozone.

It is formed by chemical reactions in the atmosphere, from precursors like hydrocarbons and nitrogen oxides, generated by combustion processes, mainly from industrial and vehicle emissions.

The estimated percentage of foliar injuries is made visually for ozone.

CETESB had already inventoried ozone distribution in a number of municipalities, like as Sorocaba, Cabreúva, Biritiba-Mirim, Brotas e Rio Grande da Serra, using Nicotiana tabacum Bel W3 as bioindicator.

Metallic Elements

Recently, the section has been evaluating the foliar concentration of metallic elements (Cd, Pb, Hg and Ni) from species of interest, present in regions subjected to industrial pollution, such as Cubatão and Paulínia.