Science Policy News

The Second VDI-International Conference on Effects of Atmospheric Precipitations on Soils: Uptake, Assessment and Regulation (Lindau, Germany, 15–17 May 1990)

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The International Conference of the 'Verein Deutscher Ingenieure' (VDI; Society of German Engineers) assembled 240 experts in soil science, economy and politics from Germany, Austria and Switzerland to assess the state-of-the-art of all aspects of soil protection, and to discuss the first effects of the soil protection regulations issued by the Federal German government in 1987. The more than 80 presentations and discussions fell under 7 major headings:
(1) Deposition and availability of acids; (2) Deposition and availability of metal compounds; (3) Behavior of inorganic fertilizers and salts in soils and groundwater; (4) Sources and behavior of organic compounds in soils and groundwater; (5) Biomonitoring and uptake by plants; (6) Effects on microorganisms and plants; and (7) Secondary effects on man.

Only within the last ten years has it been recognized that changes occur in soils due to atmospheric precipitations, and that these soils should not be considered simply as 'black boxes'. Different soil functions must be distinguished: the pedosphere (the soil) interacts with the lithosphere, the atmosphere, and the biosphere. Soils contain – and must contain – many living organisms, but so far no 'red lists' have been established to protect, for instance, soil microorganisms. Apart from microorganisms, plants are also able to interact with atmospheric inputs, protecting them and the soil against direct and indirect damage. Since soils are very inhomogeneous regional evaluations and monitoring of soil constituents are required.

It is, in many cases, almost impossible to distinguish 'natural' from overlapping anthropogenic contamination. The Lindau Conference recommended therefore classification of soils into three types of ranges:

- 'uncritical ranges' with unlimited utilization
- 'tolerance ranges' with restricted utilization: each individual type of soil may have a different sensitivity. Thus, threshold limits for gardens and playgrounds may be lower than for other utilizations.
- 'overloaded ranges' showing toxic effects on the soil products to be protected: the guidelines must be such that soil organisms are not damaged and that agricultural products must be healthy; in some cases, soil rehabilitation may be necessary.

Soils must also be preserved for future generations. Preventive measures do not solve the problems related to old contaminations and disposal sites. In these cases, rehabilitation legislation based on public consent is necessary. Soil protection guidelines should be transparent and practicable. Some local compromises may be necessary – agricultural soils, for instance, are more resistant than forest soils. Deposition and sinks of protons, nitrates and sulfates are highest in forests (with a maximum in conifer stands), whereas lead and ammonium concentrations are highest at the forest edges. Grassland for fodder is somewhat more critical than plowed land. Granite and slate soils are much more sensitive than lime soils.

The ratios between nitrate and sulfate are on the increase in many soil types. Thus, regional differences in deposition of acid-forming substances also depend on the acceptor – the soil type. The main sources of protons are urban and industrial emissions (note that the effects of road traffic are generally decreasing). Additional proton influx is due to mobilization of aluminum ions. Nitrate and ammonium loads may be too high in agricultural soils, and with too low magnesium/nitrate ratios the important magnesium concentrations in plants (particularly in spruce needles) may decrease. Ammonium ions also have a primary role in microbial cycles, since nitrogen influx alters both fungus and plant physiology. If the soil pH changes, new bacterial and plant species will become dominant, and humus production will consequently be changed.

These are, in brief, some of the problems of great current importance discussed at Lindau. The full Proceedings of the Conference have been published by the VDI:

Verein Deutscher Ingenieure, Kommission Reinhaltung der Luft, 'Wirkungen von Luftverunreinigungen auf Böden: Einträge, Bewertung, Regelungen', VDI Berichte 837, VDI-Verlag, Düsseldorf, 1990.

Two multi-author reviews in EXPERIENTIA are also pertinent to this topic: 'The Ecological Effects of Acid Deposition', Parts I and II, coordinated by O. Ravera, Vol. 42, pp. 329–377 and 455-520 (1986); 'Cadmium – A Complex Environmental Problem', Parts I and II, coordinated by O. Ravera, Vol. 40, pp. 1–52 and 117–164 (1984).

Other publications of interest:

Forest Decline and Air Pollution, A Study of Spruce on Acid Soils, by Ernst-Detlef Schulze, Otto L. Lange, and Ram Oren. Springer-Verlag Ecological Studies 77, Berlin/Heidelberg/New York (1989).

Environmental Chemistry and Toxicology of Aluminum, by Timothy E. Lewis. Lewis Publishers, Inc., Chelsea, Michigan (1989).

Air Pollution and Forests (Interaction between Air Contaminants and Forest Ecosystems) 2nd Edn., by William H. Smith. Springer-Verlag, Berlin/Heidelberg/New York (1990).

Air Pollution and Plant Metabolism, ed. by Sigurd Schulte-Hostede. Elsevier Applied Science, London and New York (1988).

Plant Stress from Air Pollution, by Michael Treshow and Franklin K. Anderson. John Wiley & Sons, Chichester/New York (1989).

Acid Precipitation (5 vols) ed. by Domy C. Adriano, Steven E. Lindberg, Stephen A. Norton, Willem Salomons et al. Springer-Verlag, New York/Berlin/Heidelberg (1989, 1990).

Research Articles

On the mechanism of the involvement of endothelium in reactive hyperemia

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Abstract. Experiments on anesthetized dogs and on vascular test-preparations demonstrated that reactive hyperemia (RH) was accompanied by the appearance of vasodilator in the blood, and that the level increased with the duration of occlusion of the artery. Removal of the endothelium of the part of the vascular bed studied using saponin, decreased the RH and relaxation of a test-preparation. A rise of pressure in the vascular bed, and a decrease in the deformability of the endothelium resulting from pretreatment with dimerized glutaraldehyde, affected both the hyperemia and the reaction of the vascular preparation in a similar way. It was concluded that the RH resulted from the secretion of vasoactive substances by the endothelium in response to a fall in intravascular pressure.

Key words. Reactive hyperemia; endothelium.

The capacity of the endothelium, epithelial and neuronal cells to synthesize a potent substance with a relaxing effect on smooth muscle, called endothelium-derived relaxing factor (EDRF), is an important discovery of the last decade[1-3]. The endothelium plays a significant role in the development of vascular reactions following the effect of various stimulants, producing its modulating effect through the release of relaxing and contracting factors, whose nature has recently been elucidated[4,5]. Quite recently a decisive role has been attributed to endothelium in the development of reactive hyperemia (RH)[6,7]. This effect is brought about by the release of EDRF[6].

The purpose of the present investigation was to ascertain the participation of humoral factors of endothelial origin in RH and to identify the stimulus which initiates the release of this factor by the endothelium.

Methods

RH was reproduced in the femoral vascular bed of dogs weighing 16–23 kg under chlorasol-urethane anesthesia (0.05 and 0.5 g/kg i.v., respectively) through the restoration of blood flow in the femoral artery after 30-, 60- and 120-s periods of occlusion. The presence of vasoreactive substance in the venous blood during the development of RH was determined by biological testing, as follows. A blood sample (100 µl) was taken from the femoral vein when RH reached its maximum, and instantly transferred to a tissue organ bath containing the segment (3–5 mg) of the femoral artery of the dog which was used for the bioassay of dilator activity. Depending on the mass and size, the vascular preparations were subjected to initial passive distension (5–10 mN). The vascular preparations were perfused with Krebs solution containing (mmol/l): NaCl – 133; KCl – 4.7; $NaHCO_3$ – 16.3; $NaHPO_4$ – 1.38; $CaCl_2$ – 2.5; $MgCl_2$ – 1.2; glucose – 7.8; pH 7.4, t = 37 °C. Contractile responses of the vascular apparatus were registered with a mechanoelectric transducer. Chemical removal of the endothelium of the femoral vessels was performed with saponin applied to the femoral vascular bed (1 mg/ml, after a 5-min occlusion)[8]. Endothelium removal was checked by mor-