

A Few Words about Microorganisms

Editorial

Microorganisms are organisms that are not visible without aid of microscope, i.e., with size less than 70–100 μm [1]. Microorganisms play an important role in the natural or engineered protection of environment from chemical or biological pollution and they can restore polluted or degraded environment. Microorganisms or their products can be also used in the construction to improve the mechanical properties of the ground and building materials. At the same time, the engineers have to design the technologies against microorganisms causing diseases human, animals, and plants and preventing microbial induced deterioration or corrosion. Therefore, both civil and environmental engineering includes many engineering solutions that are based on the relevant knowledge of microbiology. However, this knowledge must be not a general biological science but has to be tightly connected with the engineering problems.

Microorganisms are present in almost every location and environment on earth [2]. They are in the air, soil and water, on all plants and animals and in such extreme environments as Antarctic ice and rocks 3 km below the earth's surface where the temperature is 60 °C or more. Besides growing at extremes of temperature and pH, many bacteria survive and grow in the absence of oxygen; for these bacteria, described as anaerobes, oxygen is toxic. Microorganisms are present, too, in huge numbers and variety. The bacteria in the average human gut are estimated to comprise about 500 different species, and their total number, approximately 10^{14} (one hundred trillion), is about 10 times the number of human cells in the body and more than 10.000 times the human population of the earth. It is impossible to obtain precise data on the relative numbers of harmless and disease-causing (pathogenic) organisms for two main reasons: because new species are being identified all the time, and because of the difficulty of deciding what is harmless and what is not. Organisms that present no threat to a healthy individual might be pathogenic for a person with impaired immunity. Nevertheless, despite the extensive media attention on bioterrorism organisms and the so-called hospital 'superbugs', the harmless bacteria, together with those that are actually beneficial, grossly outnumber the pathogens; one estimate is by a ratio of more than 200.000 to 1.

Understanding the biological nature of any given environment through characterization of the microbial populations therein is of critical importance to illuminate that particular ecological system [3]. This need for characterization is particularly essential for complex wastewater environment systems, wherein both the distribution and quantity of the native microbial population can determine the success or failure of the system. Although the microbial groups found in many biological wastewater treatment systems are analogous, their relative quantities and metabolic activity can vastly differ between systems. In systems that are directly mediated by microbial activity, even small changes in the micro biota can produce instability, thereby affecting the performance of the system as a whole. Since much of the micro biota found within the wastewater system cannot be quantified



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through traditional microbiological methods, highly specialized molecular methods based on the screening of group-specific genomic biomarkers have been developed. Owing to the sheer complexity of environmental samples, many of these techniques were initially developed for medical research, and later adapted for environmental microbiological analysis. As such, many of these techniques require significant modification and optimization to suit each type of environmental sample type.

New organisms

It is difficult to look into the future and draw sound conclusions on the application technology that will be used for introducing new organisms [4]. Presumably, however, they may be packaged in one of three forms. (1) They may be applied as a dry powder or dust. (2) They could be in a liquid solution that would be sprayed onto the crop or receiver system. (3) They could be incorporated into pellets, or granules. These and other new techniques are important, as they influence where the organisms will be placed within the soil/plant interface. These application differences will alter their availability and the rate of their movement from the site.

A dusting with a powder on a thick canopy or heavy vegetation crop will place most of the organisms on the crop and very little on the soil surface. This location will allow opportunity for resuspension from a wind and loss from the target site. In this location the organisms would be influenced by moisture from dew during certain climatic conditions. Dew may wet and then attach organisms to the plant surface with subsequent drying. This type of application would provide a greater transportation opportunity for the organisms than the other two forms when a rainfall or irrigation event occurs.

The application of organisms in a liquid form will move into and perhaps through any crop canopy to or toward the soil surface. In the case of no vegetative cover and an unsaturated soil, the application will carry the organisms into the soil profile. Under these conditions, the organisms will be placed in contact with the soil and likely experience some movement into the soil particles and even attach

during the drying process. This location will increase the difficulty of detaching and suspending the organisms in runoff.

Commercial exploitation of microorganisms

It is clear that there is still a need to develop firstly, a European and secondly, an internationally effective regulatory regime in the industrial use of microorganisms, backed by a workable risk assessment scheme and practical guidelines [5]. In particular, with products of biotechnology it is essential to have a standardized risk assessment scheme that will enable a producer to perform his own pre-clearance exercise and to shorten the subsequent review period with the regulatory agency. The problems with approaches based on case-by-case evaluations are the pressures on the regulatory bodies, the proprietary implications and commercial confidentiality, international acceptability of decisions, basic project management, and the amount of practical evidence of comparison and repetition of experiments.

Codes of practice, regulations and directives on risk control are all worthwhile - if only for the reasons that they make legislators and lay people sit down and evaluate the actual hazards of a new technology. However, codifying risk is not without its problems. Regulations can form the essential framework for a safe industry but are inadequate by themselves. Reasonableness - in its true sense - is the key. Negligence in the eyes of the law or society could be defined as a level of conduct that falls below a standard of care which has been established by codes, rules, laws and natural justice in order to protect people from an unforeseeable risk of harm or the environment from a foreseeable risk of damage. It is essential that all interested parties agree on what is reasonable, so that important economic and socially useful products of industrial microbiology and biotechnology are not stifled by regulation.

Legal regulation in area of biotechnology

The rapid development of biotechnology in the last 40 years, with applications to human health and reproduction, and to the agricultural, insurance and security sectors, has generated varied policy responses from governments in the OECD countries. Though often labeled 'biotechnology regulation' the vast bulk of the policy literature is concerned with the construction of only one element of a regulatory regime - the normative structure of principles, standards

and rules [6]. Biotechnology regulation, as a field of public policy, has not yet matured to the point where other elements of regulatory regimes - notably processes for monitoring and mechanisms of behavioral modification - are routinely considered or problematized.

This pattern of neglect of the machinery for implementation of regulatory policy is common to the emergence of earlier regulatory regimes - for example, occupational health and food safety. As with those earlier stories it creates risks that the norms, elaborated after much advice and discussion, may not be rendered effective in practice. On the other hand there is an opportunity to consider an array of mechanisms, going beyond traditional instruments of command and control, through which regulatory norms might be made effective. Such an analysis reveals not only variety in the mechanisms of regulatory implementation, but also highlights the possibility that norms agreed through state decision-making processes might be bypassed and even destabilized by alternative mechanisms for the generation and application of norms over biotechnology.

Microorganisms or microbes are invisible to the human eye, and are only visible under a microscope. The science that studies them is called microbiology. By acting on microorganisms, ie on humans, animals or plants, microorganisms are divided into three groups: useful, harmful and neutral. Some microorganisms are harmful, but many are also useful. Without microorganisms the life we know might not exist.

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