

Long term Wastewater and Biosolids Application in Agriculture

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Huge quantities of treated wastewater (TMWW) and biosolids (sludge) are produced every day all over the world, which exert a strong pressure on the environment. An important question that is raised is “what to do with them?” As the natural resources are being depleted, the demand for clean potable water increases, the irrigation water needs also increase, and the climate is warming, the management of wastewater in this context is becoming a challenging situation.

An effort is put by the scientific community to eliminate the concept of “waste” and to replace it with the concept of “recycling of resources”, by means of effective and modern management, which includes issues of converting for example the biosolids into useful products, such as organic fertilizers, building materials, biogas etc. On the other hand, wastewater, and biosolids reuse in agriculture, is an attractive option, offering a partial solution to this urgent problem. The disposal of the above byproducts is becoming more complex. The management of these wastewater treatment byproducts must concern not only the users, but all the other groups involved in the problem, such as facility administrators, operations, politicians, scientific community and the general population [1].

A basic characteristic of wastewater and sludge is that they both have a potential to cause health risk effects and therefore the main requirement for their reuse is for the application to be safe. Consequently, the question which is raised at this point is whether the application of these inputs is safe. Harisson et al. [2] reported that sludge samples contained 516 chemicals in detectable concentrations. Lewis and Gattie [3] reviewed and assessed the decrease of risk from known pathogens in land applied sewage sludge. It is pointed out that this risk will be greatly exacerbated by the chemical toxins present in the sludge.

Another important problem has been reported by Ghosh [4], related to sludge application. According to it, while the bacterial levels 13 days after application decreases to control levels, *Staphylococcus aureus* increases to its highest level after 13 days from application. The appearance of symptoms, such as: eye, nose, and throat irritation, gastrointestinal abnormalities, as nausea, vomiting, diarrhea, also cough, difficulty in breathing, sinus congestion, skin infection and sores, was reported by Lowman et al. [5] in the people living near the sludge application sites.

An important problem, related to biosolid application in agriculture is the resistance of pathogens to antibiotics and to the evolution of multidrug resistance of bacteria, which is universally recognized and acknowledged as an “international health crisis”. The “US clean Act” defines sewage sludge as pollutant. As the wastewater contains many contaminants, during the treatment process all these contaminants concentrate in the sewage sludge. On the other hand, the US National Academy of Sciences (NAS) has warned in relation to sludge that “standard strategies to manage the risk of land application do not protect public health” (NRC, 2002)

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[6]. Based on the above and on many other relevant publications, which appeared in the literature, the so called “safety” of sludge and biosolid and wastewater reuse seems to be for the time being not satisfactorily accomplished.

Therefore, it is necessary that the scientific community focus their interest in the study of the short and long term application effects of wastewater and sludge. Also, the scientists must be concerned about the numerous interactions occurring in the soil and plants, supplying them with not only plant nutrients but with heavy metals as well, exacerbating the toxicity effect and enhancing the already existing problems. Similarly, attention must be paid to developing economical methods for removing the heavy metals, toxic organic substances, and pharmaceutical compounds from wastewater during the wastewater treatment, so as to achieve safety of application.

The research team of the School of Science and Technology has been working for the last 20 years with problems concerning the wastewater and sludge, such as accumulation of heavy metals in soils and plants, elemental interactions and their contribution to soils and plants, assessment of pollution due to wastewater and sludge reuse and development of pollution indices for forecasting soil pollution with heavy metals [7,8].

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