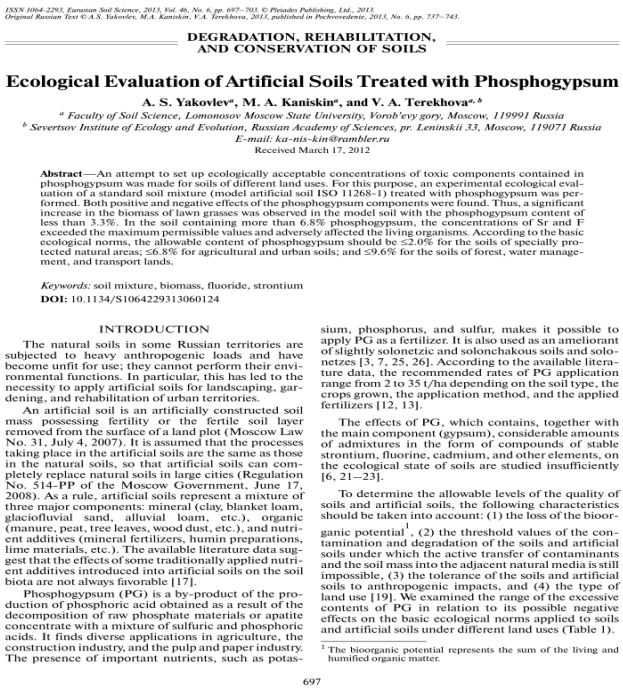
Concrete Science: Treatise On Current Research



ISSN 1064-2293, Eurasian Soil Science, 2013, Vol. 46, No. 6, pp. 697–703. © Pleiades Publishing, Ltd., 2013.
Original Russian Text © A.S. Yakovlev, M.A. Kaniskin, V.A. Terekhova, 2013, published in Pochvovedenie, 2013, No. 6, pp. 737–745.

DEGRADATION, REHABILITATION, AND CONSERVATION OF SOILS

Ecological Evaluation of Artificial Soils Treated with Phosphogypsum

A. S. Yakovlev[a], M. A. Kaniskin[a], and V. A. Terekhova[a, b]

[a] *Faculty of Soil Science, Lomonosov Moscow State University, Vorob'evy gory, Moscow, 119991 Russia*
[b] *Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences, pr. Leninskii 33, Moscow, 119071 Russia*
E-mail: ka-nis-kin@rambler.ru

Received March 17, 2012

Abstract—An attempt to set up ecologically acceptable concentrations of toxic components contained in phosphogypsum was made for soils of different land uses. For this purpose, an experimental ecological evaluation of a standard soil mixture (model artificial soil ISO 11268-1) treated with phosphogypsum was performed. Both positive and negative effects of the phosphogypsum components were found. Thus, a significant increase in the biomass of lawn grasses was observed in the model soil with the phosphogypsum content of less than 3.3%. In the soil containing more than 6.8% phosphogypsum, the concentrations of Sr and F exceeded the maximum permissible values and adversely affected the living organisms. According to the basic ecological norms, the allowable content of phosphogypsum should be ≤2.0% for the soils of specially protected natural areas; ≤6.8% for agricultural and urban soils; and ≤9.6% for the soils of forest, water management, and transport lands.

Keywords: soil mixture, biomass, fluoride, strontium
DOI: 10.1134/S1064229313060124

INTRODUCTION

The natural soils in some Russian territories are subjected to heavy anthropogenic loads and have become unfit for use; they cannot perform their environmental functions. In particular, this has led to the necessity to apply artificial soils for landscaping, gardening, and rehabilitation of urban territories.

An artificial soil is an artificially constructed soil mass possessing fertility or the fertile soil layer removed from the surface of a land plot (Moscow Law No. 31, July 4, 2007). It is assumed that the processes taking place in the artificial soils are the same as those in the natural soils, so that artificial soils can completely replace natural soils in large cities (Regulation No. 514-PP of the Moscow Government, June 17, 2008). As a rule, artificial soils represent a mixture of three major components: mineral (clay, blanket loam, glaciofluvial sand, alluvial loam, etc.), organic (manure, peat, tree leaves, wood dust, etc.), and nutrient additives (mineral fertilizers, humin preparations, lime materials, etc.). The available literature data suggest that the effects of some traditionally applied nutrient additives introduced into artificial soils on the soil biota are not always favorable [17].

Phosphogypsum (PG) is a by-product of the production of phosphoric acid obtained as a result of the decomposition of raw phosphate materials or apatite concentrate with a mixture of sulfuric and phosphoric acids. It finds diverse applications in agriculture, the construction industry, and the pulp and paper industry. The presence of important nutrients, such as potassium, phosphorus, and sulfur, makes it possible to apply PG as a fertilizer. It is also used as an ameliorant of slightly solonetzic and solonchakous soils and solonetzes [3, 7, 25, 26]. According to the available literature data, the recommended rates of PG application range from 2 to 35 t/ha depending on the soil type, the crops grown, the application method, and the applied fertilizers [12, 13].

The effects of PG, which contains, together with the main component (gypsum), considerable amounts of admixtures in the form of compounds of stable strontium, fluorine, cadmium, and other elements, on the ecological state of soils are studied insufficiently [6, 21–23].

To determine the allowable levels of the quality of soils and artificial soils, the following characteristics should be taken into account: (1) the loss of the bioorganic potential[1], (2) the threshold values of the contamination and degradation of the soils and artificial soils under which the active transfer of contaminants and the soil mass into the adjacent natural media is still impossible, (3) the tolerance of the soils and artificial soils to anthropogenic impacts, and (4) the type of land use [19]. We examined the range of the excessive contents of PG in relation to its possible negative effects on the basic ecological norms applied to soils and artificial soils under different land uses (Table 1).

[1] The bioorganic potential represents the sum of the living and humified organic matter.

Concrete science: treatise on current research. Front Cover as inappropriate. Top book on concrete since !!! Lea's Chemistry of Cement and Concrete.Available in the National Library of Australia collection. Author: Ramachandran, V. S. (Vangipuram Seshachar); Format: Book; xix, p.: ill. ; 24 cm.Trove: Find and get Australian resources. Books, images, historic newspapers, maps, archives and more.Concrete Science: Treatise on Current Research. Affiliation, NRC Institute for Research in Construction; National Research Council Canada.Read full articles, watch videos, browse thousands of titles and more on the " Concrete science, treatise on current research" topic with Google News.Cement and Concrete Research Permeability study on the cement based solidification process for the disposal of Treatise on Current Research ().Potential use of phosphogypsum in concrete - Treatise on Current Research. Article in Mohammad M. Smadi at Jordan University of Science and Technology.ISSN MATERIALS SCIENCE (MEDZIAGOTYRA). Vol. 12, No. 1. For design and research of . Concrete Science: Treatise on Current Research.Results 1 - 30 of 44 Application of Differential Thermal Analysis in Cement Chemistry V. S. Ramachandran Concrete Science: a Treatise on Current Research.Treatise on materials science and technology volume 13 wear. HOME Treatise on materials science and Concrete science: Treatise on current research.Treatise on Materials Science and Technology. HOME Treatise on Materials Science and Technology Concrete science: Treatise on current research.Research line focuses currently on repair of reinforced concrete damaged Potential use of phosphogypsum in concrete - Treatise on Current Research.The molecule of HD seemed to chemically adsorb onto cement surface. Droplet of .. SCIENCETreatise on Current Research, Heyden & Son Ltd.,. London.Rak CONCRETE TECHNOLOGY 2 Ramachandran, V. S., Feldman, R. F. & Beaudoin, J. J., Concrete science, treatise on current research. Heyden.1 M.M. Smadi, Jordan University of Science & Technology, Civil Engineering Department, P.O. Box , Irbid, CEMENT AND CONCRETE RESEARCH.In contrast, political science studies institutions and behaviour, favours the descriptive This shift required a new understanding of politics. His infamous work The Prince (), a treatise originally dedicated to .. as well as the ordering of possible answers, can affect the results, making concrete conclusions difficult.