



Kinetics of sulphate release in soils of Jharkhand

BRAJENDRA*, L.M. SHUKLA¹, B.S. KHERAWAT² AND MUNNA LAL³

Division of Soil Science, ICAR Research Complex for NEH Region,
UMIAM (MEGHALAYA) INDIA (Email : braj_2222@rediffmail.com)

Abstract : Ten selected soils from Alfisols and Ultisols soil orders of Jharkhand having varied physico- chemical properties were extracted with 0.15% CaCl_2 (1: 5 soil solution ratio) at selected time intervals (15, 30, 45, 60, 120, 300, 600 and 1200 minutes). The results indicated that each soil has differential variable with respect to sulphate desorption. The amount of sulphate S desorbed by 0.15 % CaCl_2 at different time intervals varied from 11.60 in Alfisol of Dhanbad after 15 minutes of extraction to 63.13 mg kg^{-1} after 1200 minutes. The mean amount of sulphate desorbed at different time intervals varied from 19.84 to 43.86 mg kg^{-1} . The per cent of sulphate S desorbed was more in Alfisols as compared to Ultisols. The amount of sulphate S desorbed varied with soil type as the rate of desorption reaction is controlled by the diffusion of sulphate ions through soil particles or aggregates. The amounts of sulphate S desorbed at different time interval were fitted into different kinetic models wherein it was found that the desorption of sulphate in the soils of Jharkhand was satisfactorily described by the first estimate equation.

Key Words : Kinetics, Sulphate, Soils, Alfisols, Ultisols

View Point Article : Brajendra, Shukla, L.M., Kherawat, B.S. and Lal, Munna (2013). Kinetics of sulphate release in soils of Jharkhand . *Internat. J. agric. Sci.*, 9(1): 139-144.

Article History : Received : 05.07.2012; Revised : 16.09.2012; Accepted : 08.11.2012

INTRODUCTION

Kinetics of soil chemical process is one of the most controversial, challenging and exciting areas in soil and environmental chemistry (Aylmore *et al.*, 1967). Even though the equilibrium studies are often not applicable in the field conditions (because the soils are nearly always at disequilibrium with respect to ion transport and organic molecule interaction), the results of these studies have proven enlightening and beneficial. Soils, which have been exposed to high sulphur loading, and have a relatively small sulphate retention capacity may show, more release than adsorption.

Sulphate adsorption on kaolinite (Aylmore *et al.*, 1967), is mostly reversible (> 50%) but sulphate adsorbed on to Fe and Al oxides is essentially irreversible (50%). The mechanism of retention and release of S from soil is an important factor in S nutrition. The salient reasons for studying the rate of soil chemical processes are: to predict how quickly reactions

approach equilibrium or quasi - equilibrium and to investigate the reaction mechanisms. Various adsorption studies suggest that sulphate might be held in various soil fractions each having unique retention sites and energy of each retention site will add in predicting the desorption and release of soil S and in describing chemical and physical procedures to just enhance the sulphate removal.

The aim of the present study was to study kinetics of sulphate desorbed, to compute the order of reaction followed when adsorbed SO_4^{2-} is desorbed at different time intervals and to test a suitable kinetic model for desorption of sulphate for soils of Jharkhand.

MATERIALS AND METHODS

Surface soil samples (0-15 cm) were collected in bulk from twenty different sites from plateau region of Jharkhand comprising the districts of Dhanbad, Giridih, Hazaribagh and

* Author for correspondence:

¹Division of Soil Science and Agricultural Chemistry, Indian Agricultural Research Institute, (NEW DELHI) INDIA

²Division of Crop Improvement, Central Soil Salinity Research Institute, KARNAL (HARYANA) INDIA

³Division of Resource Management, CRIDA, HYDERABAD (A.P.) INDIA