

ABSTRAK

Paraquat (1,1'-dimethyl-4,4'-bipyridylium dichloride) dikenal sebagai herbisida yang sangat toksik dan penggunaannya cukup luas di kalangan petani. Bahan ini dapat diadsorpsi oleh koloid tanah dan dapat mencemari tanah dan air. Penelitian ini bertujuan untuk mengetahui kemampuan tiga subgrup tanah berlainan ordo mengadsorpsi paraquat, menemukan jenis amelioran yang paling baik dalam menekan residu paraquat, serta mempelajari pengaruhnya terhadap bobot kering tanaman jagung. Penelitian dilakukan dalam tiga tahap, yaitu (1) survai lapangan dan deskripsi pedon perwakilan tiga ordo tanah, (2) percobaan laboratorium, meliputi (i) Uji adsorpsi maksimum paraquat pada tiga subgrup tanah berdasarkan persamaan Langmuir, dan (ii) pengaruh jenis dan dosis amelioran pada tiga subgrup tanah terhadap adsorpsi, pH, dan daya hantar listrik, dan (3) percobaan rumah kaca, untuk mengetahui pengaruh tiga jenis amelioran (zeolit, arang aktif, bokasi jerami) dan tiga subgrup tanah tercemari paraquat (pada titik jenuh dan 1% titik jenuh) terhadap residu paraquat, pH dan KTK tanah serta bobot kering tanaman jagung (*Zea mays* L.). Hasil percobaan di laboratorium menunjukkan bahwa lapisan atas Hapludand Tipik didominasi oleh mineral liat haloisit dan sedikit amorf. Sedangkan Hapludult Tipik didominasi kaolinit dan sedikit smektit, selanjutnya Endoaquert Kromik didominasi smektit dan sedikit kaolinit. Titik jenuh paraquat pada ketiga subgrup tanah tersebut masing-masing sebesar 1,883 cmol kg⁻¹, 20,833 cmol kg⁻¹, dan 9,346 cmol kg⁻¹. Jenis dan dosis amelioran masing-masing berpengaruh nyata terhadap adsorpsi paraquat, pH tanah dan daya hantar listrik pada ketiga subgrup tanah, kecuali kapasitas adsorpsi paraquat dan pH tidak dipengaruhi pada Hapludult Tipik. Arang aktif dosis 20% media tanah mampu mengadsorpsi paraquat nyata lebih tinggi dibandingkan dengan perlakuan lainnya pada Hapludand Tipik, sedangkan pada Endoaquert Kromik, arang aktif memiliki pengaruh yang sama dengan zeolit, tetapi lebih tinggi dari jerami dan kontrol. Selanjutnya, pada Hapludult Tipik perlakuan, bahan amelioran tidak berpengaruh terhadap adsorpsi paraquat, kecuali jika dibandingkan dengan kontrol. Hasil percobaan rumah kaca menunjukkan bahwa kombinasi subgrup tanah pada kondisi titik jenuh paraquat dengan amelioran menunjukkan tanaman jagung tidak dapat tumbuh. Pencemaran paraquat 1% titik jenuh pada ketiga subgrup tanah dengan pemberian amelioran, memperlihatkan bahwa arang aktif memberi efek signifikan lebih baik terhadap penurunan residu paraquat dan peningkatan KTK pada Endoaquert Kromik, dan hanya mampu disamai oleh arang aktif dan bokasi jerami padi sampai 4 mst. Perubahan pH tanah tidak berpengaruh terhadap adsorpsi dan residu paraquat di akhir vegetatif. Efek ameliorasi lebih nyata pada Hapludult Tipik, dengan peningkatan bobot kering tanaman sebesar 4,6 kali lebih tinggi dibandingkan tanpa amelioran pada subgrup tanah tersebut.

Kata Kunci: Paraquat, subgrup tanah, adsorpsi, amelioran.

ABSTRACT

*Paraquat (1,1'-dimethyl-4,4'-bipyridylium dichloride) was known as a highly toxic herbicide and used quite widely by the farmers. This material could be adsorbed by soil colloids and could contaminate the soil and water. This study aimed to determine the ability of three of soil subgroups of different orders to adsorb paraquat, finding the best kind of ameliorant in reducing residues, and studied its effect on corn crops. The study was conducted in three stages, namely (1) field survey and pedon descriptions typical for three soil orders, (2) laboratory experiments, including (i) to test the maximum adsorption of paraquat on the three of soil subgroups based on the Langmuir equation, and (ii) to study the influence of the type and ameliorant dose on three soil subgroups saturated with paraquat, and (3) greenhouse experiments, to study the effect of three types of ameliorant (zeolites, activated charcoal, rice straw compost) and three soil subgroups contaminated with paraquat (at saturation point and 1% saturation point) on paraquat residues, soil pH and CEC and the dry weight of corn plant (*Zea mays* L.). The results of laboratory experiments showed that the topsoil layer of Typic Hapludands dominated by halloysite and little amorphous clay minerals. While predominantly Typic Hapludults dominated by kaolinite and little smectite. Chromic Endoaquerts contained little kaolinite and dominated by smectite. Saturation point in all three soil subgroups amounted to 1.883 cmol kg⁻¹, 20.833 cmol kg⁻¹, and 9.346 cmol kg⁻¹ paraquat. The type and dose of each ameliorant significantly effected paraquat adsorption, soil pH and electrical conductivity in all three soil subgroups, except for paraquat adsorption and pH were not affected in Typic Hapludults. The highest dose of activated charcoal adsorbed paraquat markedly higher compared with other treatments on Typic Hapludands, whereas on Chromic Endoaquerts activated charcoal had the same effect with the zeolite, but higher than straw and control. Furthermore, on Typic Hapludults ameliorant did not significantly affect the adsorption of paraquat, except when compared with controls. The results of greenhouse experiments showed that paraquat contamination of three soil subgroups at the saturation point were lethal dose for corn seedling. Pollution of paraquat at 1% saturation point in all three soil subgroups, showed that the amelioration of activated charcoal gave significantly better effect on residue decreasing and CEC increase in Chromic Endoaquerts, and only equalized by the activated charcoal and bokasi rice straw till 4 WAP (week after planting). Changes in soil pH had no significant effect on the adsorption and paraquat residues at the end of the vegetative growth. Amelioration effect was more obvious in Typic Hapludults with increase of plant dry weight 4.6 times higher than in soil without ameliorant.*

Keywords: Paraquat, soil subgroups, adsorption, ameliorant.