Pemulihan lahan: remediasi tanah sawah tercemar insektisida endosulfan dengan memanfaatkan limbah pertanian secara berkelanjutan = Land recovery remediation of paddy soil contaminated endosulfan insecticide through using sustainable agricultural wastes

Elisabeth Srihayu Harsanti, author

Abstrak

ABSTRAK
Endosulfan adalah salah satu senyawa POPs organoklorin pada era revolusi hijau yang disukai petani karena kemanjurannya. Namun saat ini masih ditemukan di lapang. Endosulfan bersifat persisten, bioakumulatif, dan sangat toksik terhadap makrobiota. Keberadaan endosulfan harus dipantau dan dilakukan upaya reduksinya agar tidak mencemari lingkungan, dan untuk keamanan pangan, serta memenuhi ketentuan Konvensi Stockholm. Sekitar 18,12 dari total tanah sawah di Kabupaten Jombang telah terkontaminasi endosulfan dengan kategori telah melebihi Batas Maksimum Residu BMR dan 22,5 di bawah BMR. Upaya remediasi harus dilakukan dengan memanfaatkan sumberdaya lokal di Kabupaten Jombang seperti limbah tongkol jagung dan pupuk kandang. Limbah tongkol jagung belum optimal dimanfaatkan. Biochar dari limbah tongkol jagung berpotensi untuk memperbaiki tanah sawah terkontaminasi endosulfan. Penelitian ini bertujuan 1 mengetahui kemampuan teknologi remediasi dengan limbah pertanian berbasis sumberdaya lokal dalam memperbaiki kualitas tanah sawah dan produk pertanian tercemar insektisida endosulfan, 2 mengkaji dampak teknologi remediasi dengan limbah pertanian berbasis sumberdaya lokal pada tanah sawah tercemar endosulfan dengan menggunakan perangkat valuasi ekonomi, sosial, dan lingkungan dan 3 membangun model statistik remediasi berkelanjutan dengan limbah pertanian berbasis sumberdaya lokal pada tanah sawah tercemar endosulfan. Penelitian dilakukan pada bulan Juni 2015-Mei 2016 dengan metode survey dan eksperimen di rumah kaca. Eksperimen di rumah kaca menggunakan rancangan percobaan acak lengkap dengan tujuh perlakuan kombinasi biochar dan kompos kotoran ternak yang diulang tiga kali. Hasil penelitian menunjukkan 1 Teknologi remediasi tanah sawah tercemar insektisida endosulfan dengan limbah pertanian dapat memperbaiki kualitas tanah dan produk pertanian padi . Kombinasi biochar tongkol jagung dan kompos kotoran sapi atau ayam 1:4 efektif sebagai bahan pembenah tanah untuk remediasi tanah sawah tercemar residu insektisida endosulfan dengan kemampuan mempercepat penurunan ?-endosulfan hingga lebih rendah dari konsentrasi BMR < 0,0085 ppm berkisar 66,5 - 70,9 dengan waktu remediasi selama 74 hari 21 hari lebih cepat daripada tanpa remediasi ; Kombinasi biochar tongkol jagung dengan pupuk kandang sapi atau ayam pada nisbah 1:4 dapat menurunkan residu metabolit endosulfan sulfat hingga di bawah BMR < 0,0085 ppm masing-masing sebesar 1,8 -67,3 pada MT I, dan 49,7 -67,7 pada MT II dan terjadi pada kondisi anaerob; Kombinasi biochar dan kompos kotoran ternak mampu meningkatkan kesuburan tanah antara lain pH, P tersedia, C organik tanah, N total, dan populasi bakteri dalam tanah; serta meningkatkan hasil padi 10-13 2 Teknologi remediasi dengan memanfaatkan biochar tongkol jagung yang dikombinasi dengan kompos kotoran ayam atau sapi dapat memberikan dampak positif pada aspek ekonomi, sosial, dan lingkungan sehingga inovasi tersebut dapat diterima oleh petani; dan 3 Model statistik remediasi tanah sawah Inceptisol tercemar residu endosulfan dengan memanfaatkan limbah pertanian dapat dibangun dengan mempertimbangkan karakteristik tanah terutama kandungan C-organik tanah dan populasi bakteri

total dalam tanah.Kata kunci: limbah tongkol jagung, kompos kotoran sapi, kompos kotoran ayam biochar, remediasi, endosulfan, keberlanjutan

<hr />

ABSTRACT

Endosulfan is one of POPs organochlorine compounds on green revolution era that was mostly preferred by farmers because of its efficacy. However, it still found in the field. Endosulfan is persistent, bio accumulative, and most toxic on macrobiota. Its existence in soil must be monitored and its reduction must be controlled so that it do not contaminate the environment and food safety and comply Stockholm Convention. About 18.12 of total rice fields in Jombang districts has contaminated by endosulfan that has been over Maximum Residue Limits MRLs and 22,5 less of MRLs. Remediation should be done by using local sources such as corn cob waste and compost of cattle manure. In fact, the waste of corn cob has not used optimally yet. Biochar from corn cob waste has the potency to remediate rice fields contaminated endosulfan. The research objectives were 1 to determine ability of remediation technology using agricultural wastes based local resources in improving quality of paddy soil and agricultural products that polluted by endosulfan insecticide, 2 to study the impacts of remediation technology using agricultural wastes based local resources in rice fields contaminated by endosulfan through economic, social, and environment valuation instruments, and 3 to arrange statistical model of sustainable remediation using agricultural waste based local resources in rice field contaminated by endosulfan. The research was conducted from June 2015 till May 2016 using survey and screen house experiment methods. The screen house experiment was arranged using completely randomized design with seven treatment of combination of corn cob biochar and farmyard manure with three replicates. The research result showed that 1 remediation technology of rice fields contaminated by endosulfan using agricultural waste as a soil amendment could improve the quality of paddy soil and rice products. The combination of corn cob biochar and compost of cattle manure or chicken manure 1 4 could effectively remediate rice field contaminated by endosulfan insecticide till less than MRLs 0.0085 ppm as much as 66.5 ndash 70.9 . The time of remediation to reduce the residue up to less than MRLs was 74 days 21 days faster than without remediation . The combination of corn cob biochar and cattle manure or chicken manure with 1 4 ratio could decrease endosulfan sulfate metabolite less MRLs 0,0085 ppm 1.8 67.3 in 1st cropping season and 49.7 67.7 2nd cropping season , respectively, that a decrease is in anaerobe condition Soil amendment could increase soil fertility, i.e. pH, available P, soil organic C, total N, and bacteria population and increased 10 13 of rice yield 2 remediation technology using corn cob biochar combined manure from either cattle or chicken could impact positively on aspects of economy, social, and environment so that innovation could be acceptable by farmers and 3 statistical model of remediation of Inceptisol rice field that contaminated by endosulfan using agricultural waste could be built with considering soil characteristic especially organic C and soil bacteria total factors. Its usage was suitable with level of endosulfan contamination and has some similarities ecological characteristics.Keywords corn cob waste, cattle manure compost, chicken manure compost, biochar, remediation, endosulfan, sustainability.