（様式４）

二国間交流事業 共同研究報告書

令和４年４月１日

独立行政法人日本学術振興会理事長 殿

[代表者所属機関・部局]
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1. 事　業　名 相手国:バングラデシュ (振興会対応機関:UGC)との共同研究

2. 研究課題名

（和文）デルタ地域における土壌特性と農産物への塩分濃度の影響及び土壌浄化効果の究明

（英文）Physiochemical study to determine the impact of salinity of soil property and agro produce of delta region and its remediation

3. 共同研究全実施期間 平成30年10月1日 ～ 令和4年3月31日 (3 年 6ヶ月)

4. 相手国代表者(所属機関・職・氏名【全て英文】)

Jahangirnagar University・Professor・Mohammad Amir Hossain Bhuiyan

5. 委託費総額(返還額を除く)

本事業により執行した委託費総額	5,310,724	円
内訳	1年度目執行経費	1, 156, 338 円
	2年度目執行経費	2, 805, 000 円
	3年度目執行経費	1, 349, 386 円

6. 共同研究全実施期間を通じた参加者数(代表者を含む)

日本側参加者等	12名
相手国側参加者等	6名

＊ 参加者リスト(様式 B1(1))に表示される合計数を転記してください(途中で不参加となった方も含め、全ての期間で参加した通算の参加者数となります)。

7. 派遣・受入実績

	派遣		受入
	相手国	第三国	
1年度目	4	0	(2)
2年度目	0	0	(2)
3年度目	0	0	(0)
4年度目	0	0	(0)

＊ 派遣・受入実績（様式 B1(3)）に表示される合計数を転記してください。
派遣：本委託費を使用した日本側参加者等の相手国及び相手国以外への渡航実績（延べ人数）。
受入：相手国側参加者等の来日実績（延べ人数）。カッコ内は本委託費で滞在費等を負担した内数。

8. 研究交流実績の概要・成果等

(1)研究交流実績概要（全期間を通じた研究交流の目的・研究交流計画の実施状況等）

Under this project, we collected fifty-four soil samples from agricultural lands of Dhaka. We analyzed them for assessing the accumulation, spatial enrichment, ecological risk, and sources apportionment of heavy metals using a combined approach of self-organizing map (SOM), positive matrix factorization (PMF), geographical information system (GIS), and enrichment factor (EF).

(2)学術的価値（本研究交流により得られた新たな知見や概念の展開等、学術的成果）

The results of the enrichment factor, geoaccumulation index, and contamination factor index showed that more than 90% of the soil samples were polluted by higher levels of Cr and Cd. The mean pollution load index (PLI) results demonstrated that about 73% of soil samples were moderately polluted by heavy metals. Based on a Self-organizing map (SOM) and Positive Matrix Factorization (PMF) analysis, four potential sources of heavy metals were found in this study area: (i) agrochemical and sewage irrigation (Cd–As); (ii) combined effect of agriculture, industrial and natural sources (Mn, Co, Ni, and Zn); (iii) atmospheric deposition and industrial emission (As–Pb); (iv) chemical and leather tanning industries (Cr).

According to Fig. 1, it was observed that Factor 1 was highly loaded with Cd (79.4%), which was the principal element representing the source of pollution in this factor. In addition, factor 1 was moderately loaded with As (37.2%), Co (34%), Cr (29%), and Cu (26%). Though the loading of Cd was dominated in the study area, there was no single point source to release Cd. A large coefficient of variation of Cd among the elements might suggest a stronger anthropogenic influence. It was observed that factor 1 was widely distributed in the study site. The enrichment of Cd and associated heavy metals at this factor was mostly coming from the excess application of fertilizers.

Factor 2 was described by Co, Ni, Zn, Pb, Cu, and Cr content with loadings of 42%, 31%, 27%, 22.7%, 21.4%, and 20%, respectively. Co dominated this factor, and Co might be derived from natural sources. In most of the soil samples, Ni and Cr were concentrated higher than the natural background values and even exceeded the environmental quality standards.

Factor 3 was dominated by As and Pb with loadings of 48.6% and 37%, respectively, and moderately loaded with Cu, Mn, Zn, and Fe with loadings of 32.4%, 30%, 29.7%, and 24.1%, respectively. Though As contaminated groundwater irrigation may contribute to higher As accumulation in soils, the deposition of atmospheric aerosols and pesticides may contribute As in soil. Lead is mostly derived from emissions from fossil fuels, vehicle tires, and brake pads.

Factor 4 was predominated by Mn and Cr with loadings of 43.8% and 41.4%, respectively. According to the analysis of Enrichment factor (EF) values for Mn, all samples exceed the background values, which indicated anthropogenic sources.

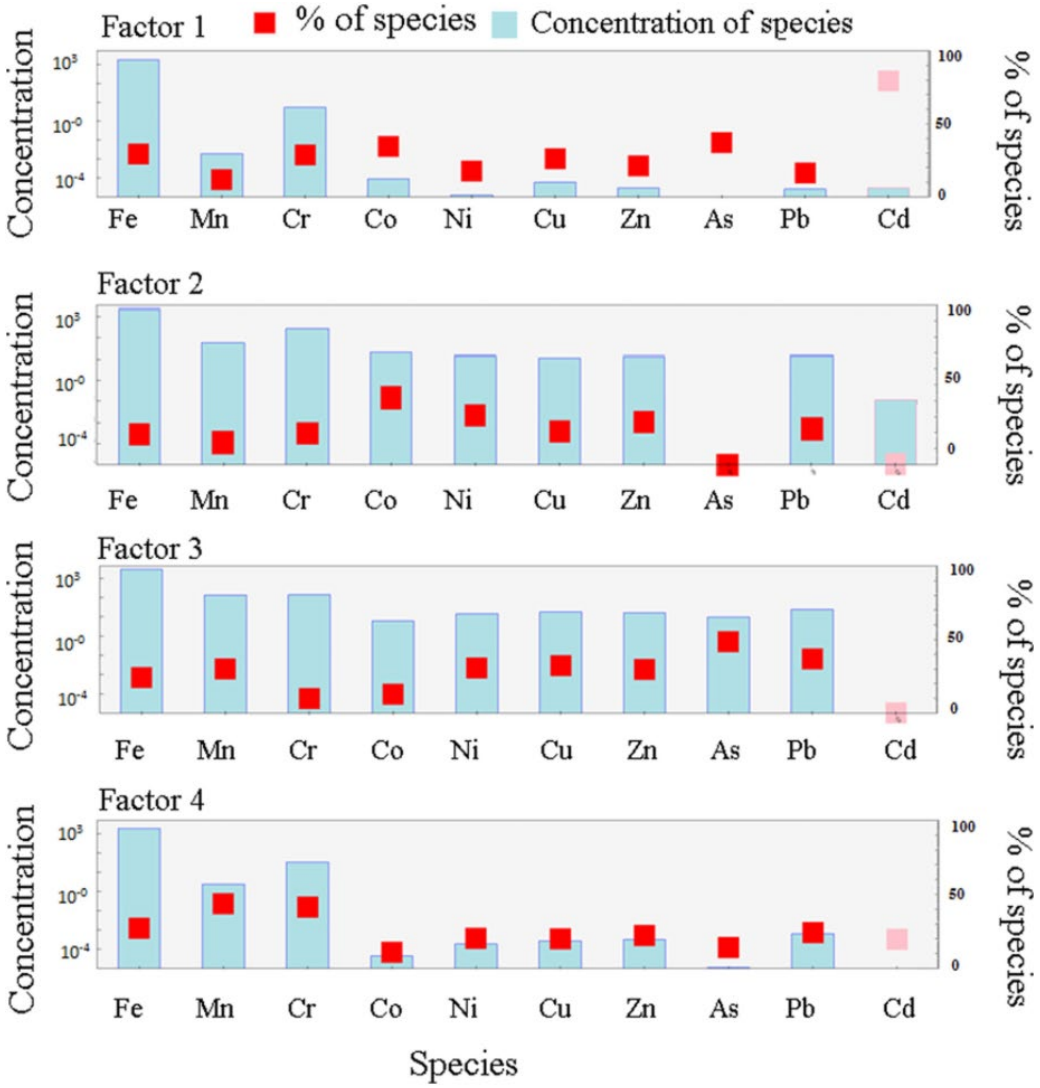

Fig. 1. Profiles and contributions of sources of heavy metals in Bangladesh agriculture soil using the PMF model.

⑶相手国との交流（両国の研究者が協力して学術交流することによって得られた成果）

The ecological risk index demonstrated that in terms of Cd content, about 75% of soil samples were moderate to high risk, and 20% were moderate to considerable ecological risk, which was the serious environmental, ecological, and public health concern

⑷社会的貢献（社会の基盤となる文化の継承と発展、社会生活の質の改善、現代的諸問題の克服と解決に資する等の社会的貢献はどのようにあったか）

The spatial projection of ecological risk values showed that the southern part of Dhaka (Keraniganj Upazila) is at high ecological risk in terms of heavy metal pollution.

⑸若手研究者養成への貢献（若手研究者養成への取り組み、成果）

Traveling was difficult due to COVID 19, but I would like to continue to train young researchers through future exchanges and online meetings.

(6)将来発展可能性（本研究交流事業を実施したことにより、今後どの様な発展の可能性が認められるか）

These risk maps in agricultural soils may play a vital role in reducing pollution sources; so that zonal pollution control and ecological protection may be achieved in this resource-based agricultural land.

(7)その他（上記(2)～(6)以外に得られた成果があれば記述してください）
例：大学間協定の締結、他事業への展開、受賞、産業財産権の出願・取得など