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CONTENTS AND DISTRIBUTION PATTERN OF TRACE ELEMENTS IN GROUNDWATERS OF JODHPUR DISTRICT IN WESTERN RAJASTHAN

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ABSTRACT

Concentration and distribution pattern of some major trace elements viz., copper, iron, lead, lithium, manganese and zinc was studied in groundwaters of Jodhpur district in western Rajasthan. The trace element concentrration varied considerably with respect to hydrogeology of the region, depth, salinily, total hardness and alkalinity. The average concentration of Cu, Fe, Pb, Li, Mn, and Zn was found to be 31, 516, 114, 66, 157 and 237 $\mu g\ L^{-1}$ with the maximum value of 125, 5610, 416, 364, 1150 and 4000 $\mu g\ L^{-1}$ respectively.

INTRODUCTION

Study of trace elements constitutes an important part of water analysis in the field of hydrochemical and water pollution studies of groundwaters. While the normal concentration of these elements reflects the groundwater character and hydrogeological environment of a region, their abnormal values decipher a source of pollution in vicinity or presence of some specific metal bearing mineral in the area. The presence of trace elements in drinking waters may cause aesthetic or toxic effects and hence many cf them like arsenic, barium, cadmium chromium, copper, iron, lead, manganese, mercury, selenium, silver and zinc have found an important place in regulating drinking water quality (EPA 1975,77). Besides these elements some other elements like lithium cause toxicity to plants when present beyond certain limit and therefore undesirable in irrigation waters (Bradford 1963).

The present paper deals with the findings in respect of occurrence of some important trace elements like copper, iron, lead, lithium, manganese and zinc in groundwaters of Jodhpur district in western Rajasthan, a part of Indian Thar desert.

MATERIAL AND METHODS

Study area

Jodhpur district in western part of Rajasthan state covers an area of 22, 860 sq kms and lies between 25°51′ to 27°35′ north latitude and 71°48′ to 73°52′ east longi tude. The district has semi-arid climate with an annual rainfall of 370.3 mm. It is characterised by three distinct physiographic units namely alluvial plains, escarpment

Variation with respect to total hardness and alkalinity

The groundwaters are alkaline in character with pH ranging mostly between 7.0 to 8.3. There is rise in concentration of iron, lithium and copper with increase in hardness and alkalinity of water (Table 4). Zinc and manganese though did not show any positive relationship with respect to hardness, but showed quite a different trend with respect to alkalinity. While zinc concentration decreased in high alkalinity level, the concentration of manganese was found to increase constantly. Much of the present knowledge concerning zinc in the processes of weathering and sedimentation has come from studies of the oxidative weathering of sulphide ores. The formation of soluble sulphates allows its rapid removal by transport. But the soluble zinc may be removed by formation of solid phase carbonates or sulphides under appropriate redox and pH conditions. On the other hand, dissolution of manganese is enhanced in high bicarbonate waters due to formation of $MnHCO^{+}_{3}$ complex.

Table 4. Variation of trace elements with respect to total hardness and alkalinity.

Property	Range	No. of	EC	pH	Trace elements μgL^{-1} (mean value)					
	mgL^{-1} as $CaCO_3$	samples	$dScm^{-1}$		Fe	Zn	Li	Cu	Pb	Mn
A. Total	0-300	23	1.46	7.8	291	253	38	21	72	160
Hardness	300-600	23	2.23	8.0	306	223	55	28	84	67
	>600	9	6.09	7.7	389	223	93	56	159	127
B. Total	0-300	16	1.36	7.8	284	258	23	21	87	42
Alkalinity	300-600	22	2.39	7.9	319	240	44	27	82	113
	>600	10	4,88	7.8	345	186	136	50	125	243

Toxic level of trace elements

Out of six elements viz. iron, copper. zinc, manganese, lead and lithium the first four elements have their aesthetic importance in drinking waters. High concentration of these elements in drinking waters may cause a stringent taste, discolouration and turbidity and thus make it aesthetically unacceptable. The World Health Organisation (WHO 1984) has set up concentration limits of 0.3, 1.0, 5.0 and 0.1 $\mu g L^{-1}$ as the guideline value for iron, copper, zinc and manganese for drinking waters. Lead is however considered as a cumulative toxic element. It accumulates in bones where it replaces calcium. Its accumulation in body also gives rise to a wide variety of symptoms that involves mainly blood-forming mechanisms, the gastrointestinal tract, and in the advanced stage, the nervous system. WHO has set the guideline limit of 0.05 μgL^{-1} for this element in drinking waters. However, the concentration of it occurs in amounts greater than the recommended limits in groundwater at several places.

Lithium, though not an important element for drinking waters, the same has significant consideration for irrigation waters. As low as 60 to 100 $\mu g L^{-1}$ of lithium has been found to be injurious to citrus plants (Bradford 1963). The National Academy of Science and National Academy of Engineering (1972) has however, set the guide line limit of 2500 $\mu g\ L^{-1}$ irrigation waters to be used for the crops other than citrus crops. Since the average concentration of lithium in groundwaters is less than this limit, the waters are therefore free of lithium toxicity.

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