



## ASSESSMENT OF GROUNDWATER QUALITY FOR DRINKING PURPOSE IN RAJAUND BLOCK, KAITHAL DISTRICT, HARYANA

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Received on: 4.3.2022

Revised on: 5.6.2022

Accepted on: 25.6.2022

### Abstract

Assessment of water quality is important for planning and monitoring of water various purposes like drinking, irrigation and industrial uses. In the present era of developmental activities assessment of water quality is more important to avoid many health problems. The present study is carried out in Rajaund block in Kaithal district of Haryana with an objective to assess groundwater quality for drinking purpose. The geo-coordinates of the study area are latitudes 29.51° N to 29.69° N and longitudes 76.35° E to 76.58° E and covers an area of 285.25 sq. km. Geologically alluvium and geomorphologically alluvial plain are present. In the study area eight groundwater samples were collected in 250 ml double capped plastic bottles from tube wells. Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of eight groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board, Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine. Results of groundwater samples analysis were compared with BIS (IS 10500:2012) drinking water standards to know groundwater quality for drinking purpose. In the study area pH ranges 6.5 to 8, alkalinity 210 mg/l to 550 mg/l, hardness 50 mg/l to 650 mg/l, chloride 60 mg/l to 490 mg/l, TDS 540 mg/l to 1776 mg/l, fluoride 1.5 mg/l to 5 mg/l, iron nil in all eight groundwater samples, ammonia nil to 5 mg/l, nitrite 0.5 mg/l to 1 mg/l, nitrate 75 mg/l to 150 mg/l, phosphate nil in all eight groundwater samples and residual chlorine nil to 0.2 mg/l. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

### Keywords

Groundwater, quality, drinking, Rajaund, Kaithal, Haryana.

### INTRODUCTION

Water plays vital role in maintaining health of living beings. Good quality drinking water avoids many health problems like fluorosis. In the present time availability of good quality water is become scarce due to anthropogenic pollution. The need of the hour is to monitor the drinking water quality for minimizing poor water quality borne health problems. Many workers (Barber et al. (1996), Asadi et al. (2007), Babiker et al.(2007), Arumugam and Elangovan (2009), Balakrishnan et al. (2011), Deshpande and Aher (2012), Singh and Kumar (2014),Krishnaraj et al. (2015), Choudhary et al. (2016),

Vijaya Lalitha et al. (2016), Lalitha et al. (2017), Molekoa et al. (2019)) had done work on assessment of groundwater quality for drinking purpose in many areas.

### STUDY AREA

Rajaund block is located in Kaithal district of Haryana state (Fig.1). The geo-coordinates of the study area are latitudes 29.51° N to 29.69° N and longitudes 76.35° E to 76.58° E and covers an area of 285.25 sq. km. In the study area geologically alluvium and geomorphologically alluvial plain are present.

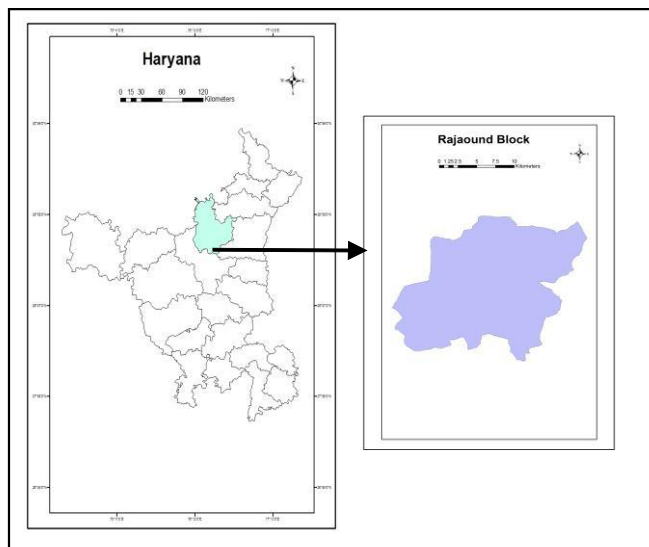


Fig.1: Location map of the study area.

## OBJECTIVE

The main objective was to assess groundwater quality for drinking purpose in the study area.

## MATERIALS AND METHODOLOGY

In the study area eight groundwater samples were collected in 250 ml double capped plastic bottles from tube wells (TW). Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of eight groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board, Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine (Table 1). Result of chemical analysis of groundwater samples were entered in excel software and prepared bar graph for each chemical parameter. Results of groundwater samples analysis were compared with BIS drinking water standards (IS 10500:2012) (Table 2) to know groundwater quality for drinking purpose.

Table 1: Results of groundwater samples analysis in the study area.

S. No.	Sample Location	Latitude	Longitude	Source	pH	Alkalinity (mg/l)	Hardness (mg/l)	Chloride (mg/l)	TDS (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Residual Chlorine (mg/l)
1	Kithana (I)	29.54	76.39	TW	8	400	370	490	1512	5	0	5	1.0	150	0	0.2
2	Kithana (ii)	29.56	76.39	TW	6.5	340	50	60	540	3	0	0	1.0	100	0	0.2
3	Jakhouli	29.66	76.44	TW	8	480	540	420	1725	5	0	1	1.0	100	0	0.2
4	Dudana (I)	29.53	76.48	TW	8	530	650	300	1776	3	0	1	0.5	75	0	0.2
5	Dudana (ii)	29.53	76.48	TW	8	550	400	200	1380	3	0	0.5	0.5	100	0	0
6	Rohera	29.56	76.42	TW	7.5	280	120	140	648	3	0	0	1.0	100	0	0
7	Rajaound	29.58	76.49	TW	8	380	90	80	660	1.5	0	1	1.0	100	0	0.2
8	Kukarkanda	29.63	76.52	TW	7	210	400	450	1272	3	0	1	0.5	100	0	0

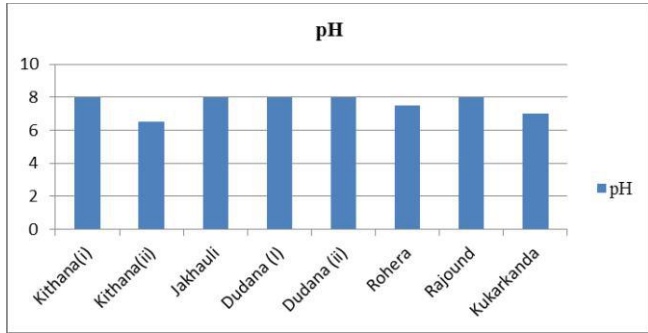
Table 2: Drinking water standards (BIS: 10500:2012).

Sl. No.	Parameters	Potable		Non potable Permissible
			Desirable	
1.	pH	6.5-8.5	-	<6.5 and >8.5
2.	Alkalinity (mg/l)	200	200-600	>600
3.	Hardness (mg/l)	200	200-600	>600
4.	Chloride (mg/l)	250	250-1000	>1000
5.	Total Dissolved Solids (mg/l)	500	500-2000	>2000
6.	Fluoride (mg/l)	<1.0	1.0-1.5	>1.5
7.	Iron (mg/l)	<0.3	-	>0.3
8.	Ammonia (mg/l)	<0.5	-	>0.5
9.	Nitrite (mg/l)	<0.1	-	>1.0
10.	Nitrate (mg/l)	<45	-	>45
11.	Phosphate (mg/l)	<1.0	-	>1.0
12.	Residual Chlorine (mg/l)	<0.2	0.2-1.0	>1.0

**RESULTS AND DISCUSSION**

**i. pH**

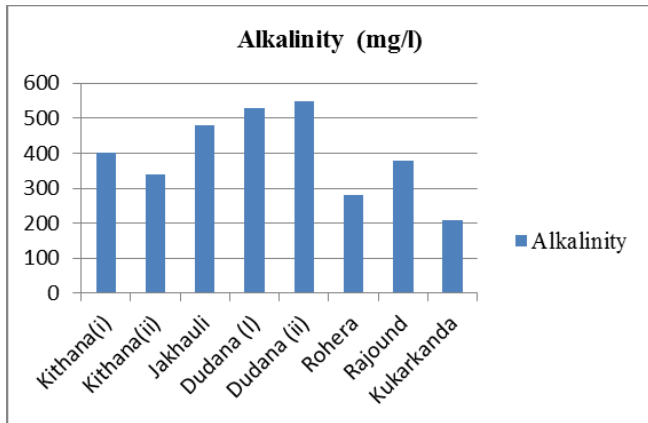
In the study area pH ranges 6.5 to 8 (Table 1, Fig.2). As per BIS drinking water standards pH is desirable between 6.5 to 8.5 and non-potable if less than 6.5 and more than 8.5 (Table 2). pH is desirable in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).



**Fig. 2: pH in groundwater samples.**

**ii. Alkalinity**

In the study area alkalinity ranges 210 mg/l to 550 mg/l (Table 1, Fig.3). As per BIS drinking water standards alkalinity is desirable if less than 200 mg/l, permissible between 200 mg/l-600 mg/l and non-potable if more than 600 mg/l. Alkalinity is permissible in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).



**Fig.3: Alkalinity in groundwater samples .**

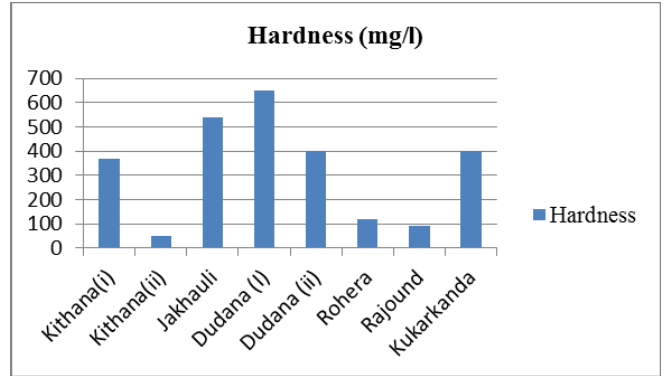
**iii. Hardness**

In the study area hardness ranges 50 mg/l to 650 mg/l (Table 1, Fig.4). As per BIS drinking water standards hardness is desirable if less than 200 mg/l, permissible between 200 mg/l-600 mg/l and non-potable if more than 600 mg/l (Table 2). Hardness is desirable in three groundwater samples (Kithana (ii), Rohera, Rajound), permissible in four groundwater samples (Kithana (i), Jakhauli, Dudana (ii), Kukarkanda) and non-potable in one groundwater sample (Dudana (i) (650 mg/l)).

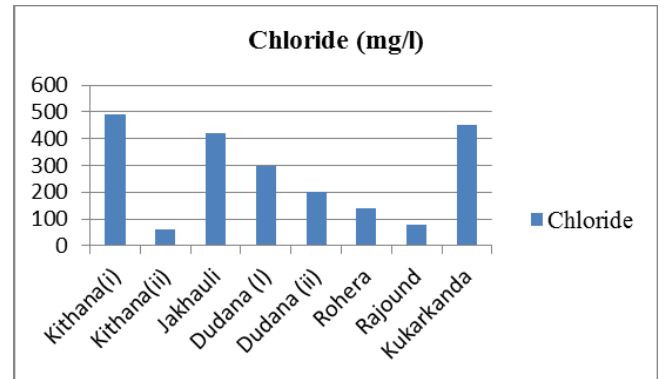
**iv. Chloride**

In the study area chloride ranges 60 mg/l to 490 mg/l (Table 1, Fig.5). As per BIS drinking water standards chloride is desirable if less than 250 mg/l, permissible between 250

mg/l-1000 mg/l and non-potable if more than 1000 mg/l. Chloride is desirable in four groundwater samples (Kithana (ii),Dudana (ii),Rohera, Rajound) and permissible in four groundwater samples (Kithana (i), Jakhauli, Dudana (I), Kukarkanda).



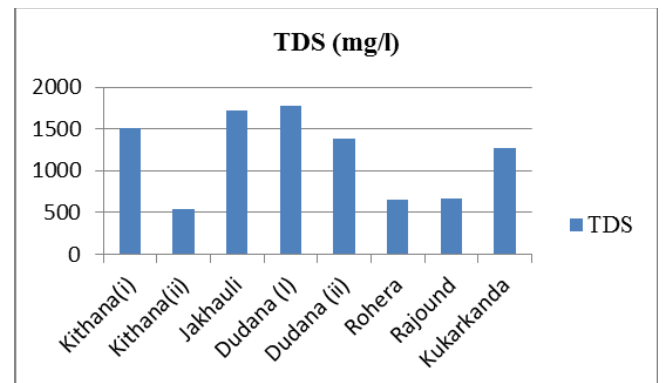
**Fig.4: Hardness in groundwater samples.**



**Fig. 5: Chloride in groundwater samples.**

**v. Total Dissolved Solids**

In the study area TDS ranges 540 mg/l to 1776 mg/l (Table 1, Fig.6). As per BIS drinking water standards TDS is desirable if less than 500 mg/l, permissible between 500mg/l-2000 mg/l and non-potable if more than 2000 mg/l (Table 2). TDS is permissible in all eight groundwater samples (Kithana (i), Kithana (ii), Jakhauli, Dudana (i), Dudana (ii), Rohera, Rajound, Kukarkanda).



**Fig. 6: TDS in groundwater samples.**

**vi. Fluoride**

In the study area fluoride ranges 1.5 mg/l to 5 mg/l (Table 1, Fig.7). As per BIS drinking water standards fluoride is desirable if less than 1.0 mg/l, permissible between 1.0mg/l -

1.5 mg/l and non-potable if more than 1.5 mg/l (Table 2). Fluoride is permissible in one groundwater sample (Rajound) and non-potable in seven groundwater samples (Kithana (i) (5 mg/l), Kithana (ii) (3 mg/l), Jakhauli (5 mg/l), Dudana (i) (3 mg/l), Rohera (3 mg/l), Kukarkanda (3 mg/l)).

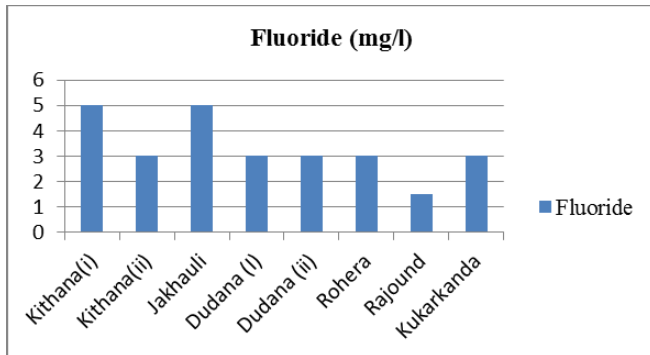


Fig. 7: Fluoride in groundwater samples.

#### vii. Iron

In the study area iron is nil in all the eight groundwater samples (Table 1, Fig.8). As per BIS drinking water standards iron is desirable if less than 0.3 mg/l and non-potable if more than 0.3 mg/l (Table 2). Iron is desirable in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

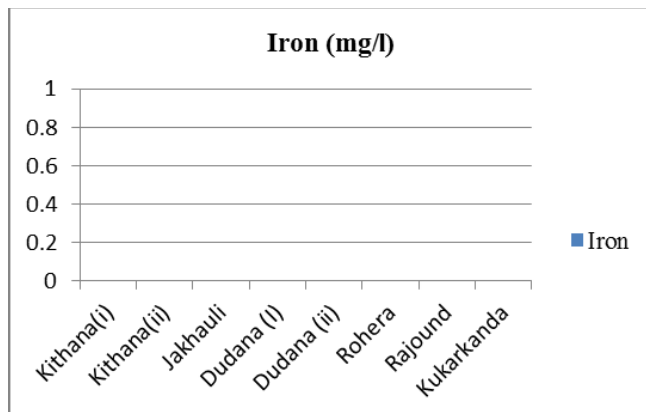


Fig. 8: Iron in groundwater samples.

#### viii. Ammonia

In the study area ammonia ranges nil to 5 mg/l (Table 1, Fig.9). As per BIS drinking water standards ammonia is desirable if less than 0.5 mg/l and non-potable if more than 0.5 mg/l (Table 2).Ammonia is desirable in three

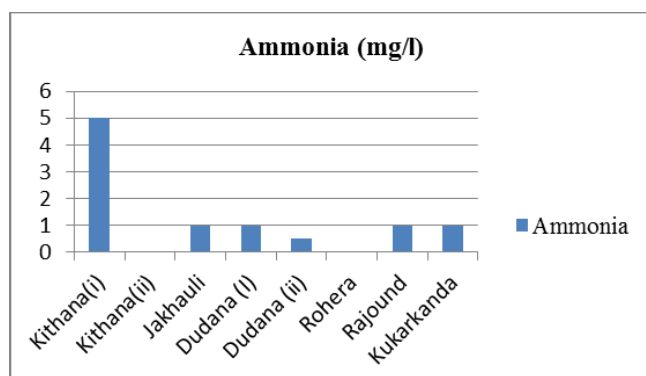


Fig. 9: Ammonia in groundwater samples.

groundwater samples (Kithana (i), Dudana (ii), Rohera) and non-potable in five groundwater samples (Kithana (i) (5 mg/l), Jakhauli (1mg/l), Dudana (i) (1 mg/l), Rajound (1 mg/l), Kukarkanda (1 mg/l)).

#### ix. Nitrite

In the study area nitrite ranges 0.5 mg/l to 1 mg/l (Table 1, Fig.10). As per BIS drinking water standards nitrite is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l.Nitrite is desirable in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

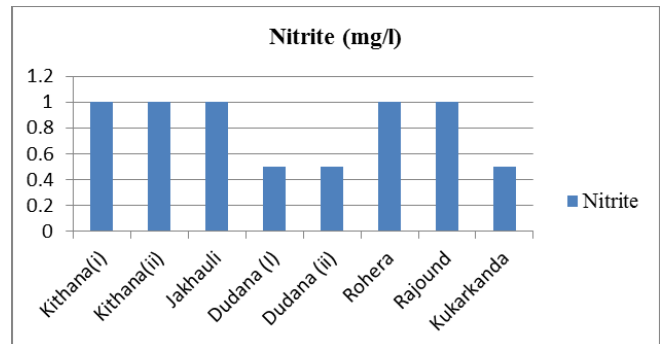


Fig.10: Nitrite in groundwater samples.

#### x. Nitrate

In the study area nitrate ranges 75 mg/l to 150 mg/l (Table 1, Fig.11). As per BIS drinking water standards nitrate is desirable if less than 45 mg/l and non-potable if more than 45 mg/l (Table 2). Nitrate is non-potable in all eight groundwater samples (Kithana (i) (150 mg/l), Kithana (ii) (100 mg/l),Jakhauli (100 mg/l), Dudana (i) (100 mg/l),Dudana (ii) (100 mg/l), Rohera (100 mg/l), Rajaound (100 mg/l), Kukarkanda (100 mg/l)).

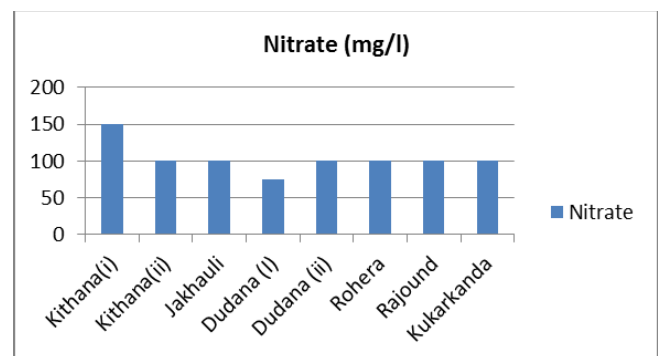


Fig. 11: Nitrate in groundwater samples.

#### xi. Phosphate

In the study area phosphate is nil in all the eight groundwater samples (Table 1, Fig.12). As per BIS drinking water standards phosphate is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Phosphate is desirable in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

#### xii. Residual Chlorine

In the study area residual chlorine ranges nil to 0.2 mg/l (Table 1, Fig.13). As per BIS drinking water standards residual chlorine is desirable if less than 0.2 mg/l, permissible between 0.2-1.0 mg/l and non-potable if more than 1.0 mg/l

(Table 2). Residual chlorine is desirable in three groundwater samples (Dudana (ii), Rohera, Kukarkanda) and permissible in five groundwater samples (Kithana (i), Kithana (ii), Jakhauli, Dudana (i), Rajound).

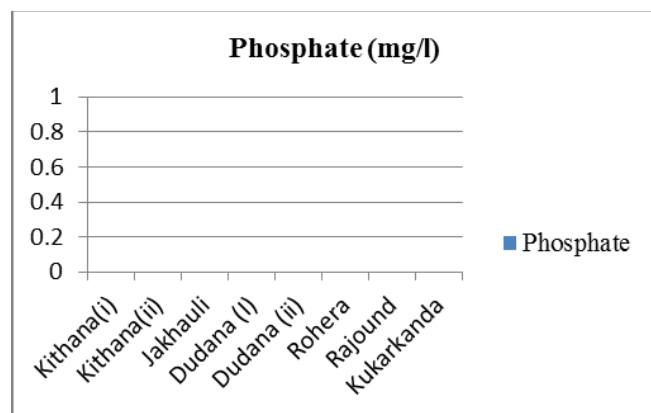


Fig.12: Phosphate in groundwater samples.

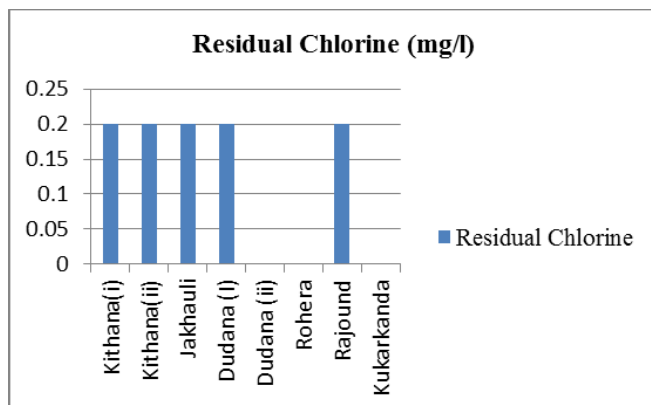


Fig.13: Residual Chlorine in groundwater samples.

## CONCLUSIONS

In the study area pH, iron, nitrite and phosphate are desirable in all eight groundwater samples. Alkalinity and TDS are permissible in all eight groundwater samples. Hardness is desirable in three groundwater samples, permissible in four groundwater samples and non-potable in one groundwater sample. Chloride is desirable in four groundwater samples and permissible in four groundwater samples. Fluoride is permissible in one groundwater sample and non-potable in seven groundwater samples. Ammonia is desirable in three groundwater samples and non-potable in five groundwater samples. Nitrate is non-potable in all eight groundwater samples. Residual Chlorine is desirable in three groundwater samples and permissible in five groundwater samples. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

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