Water Quality of Kodku Khola, Lalitpur, Nepal

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Abstract

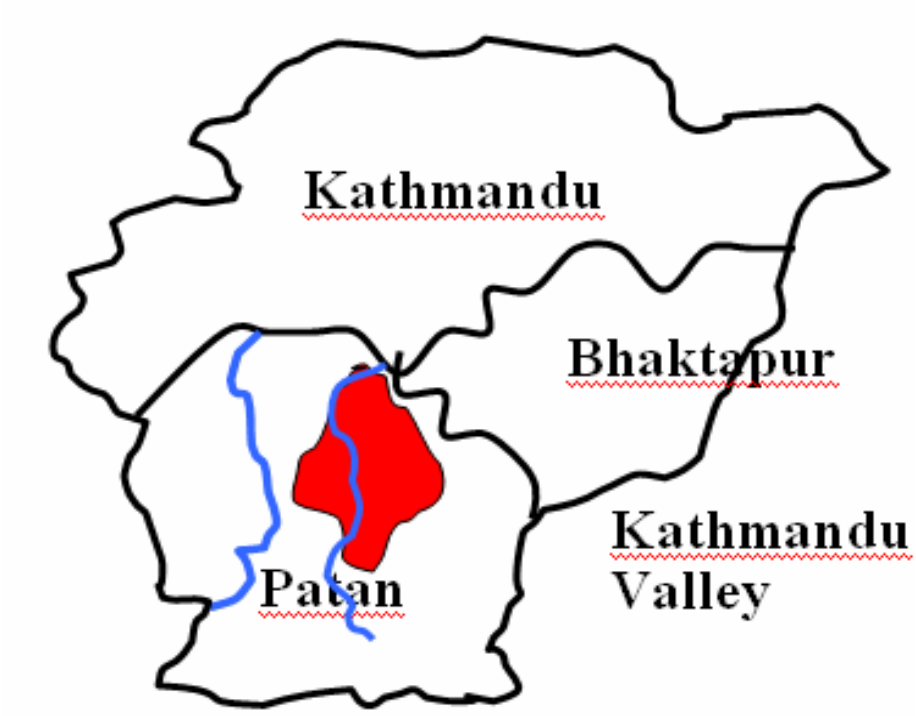
The quality and quantity of drinking water have received considerable attention recently. Analyzing demand and shrinking supplies illustrate that our progress towards sustainable management of this vital resource has been inadequate

The kodku Khola that was taken for analyzing water quality of the river is entirely focused on acquiring information about the Kodku Khola Watershed in reference to drinking water. The study and analysis of existing water quality from each source were essential to predict the after-storage quality, as well as the selection of water treatment processes. The main task is to analysis the basic quality requirements. The basic requirements for portable water were analyzed to find out if the water were free from pathogenic organisms, containing low concentrations of compounds that are acutely toxic or that have serious long-term effects, Clear, Not saline (salty), Free of compounds that cause offensive taste or odor and Non corrosive, nor should it cause staining of clothes.

Introduction

Due to lack of access to safe drinking water and rudimentary sanitation services, Incidence rates of infectious disease are high, and as a result of poor health care, infrastructure and illness often result in death. Projected changes in climate and urban and industrial development threaten drinking water integrity and sustainability. Populations, consumption and source degradation are increasing as if there were no limits to the supply of clean water.

The Kodku Khola is the north flowing river. It originates from the north facing slopes of the Tileswor Danda and Bhagwan Danda, located at the southern area of the Kathmandu Valley. The general direction of flow is from south to north, reaching to the center of the Valley and joins the Manohara River.The Kodku Khola watershed, which was taken as nearest river can be used as drinking water resource, was also analysed to check the quality of water. The raw water quality was determined by doing chemical analysis.



Geology

The area comprised rocks of the middle sections of the Phulchowki group of the Kathmandu Complex. The rock of Chandragiri Limestone is blue grey fine-grained siliceous and dolomitic limestone. It is the prominent formation of the Phulchowki Group. The rock exposed at the dam site on the riverbed and both banks for about 250-m long. Orientation of the rock beds is oblique to the river flow direction. The fluvial and lacustrine deposits consisting mainly of gravel, clay, and clayey silt occupy a greater part of the project area. The sediments are more or less unconsolidated. The recent terrace deposits occurred along the valleys of the Kodku Khola watershed.

Hydrology

Rainfall in Kathmandu valley occurs mainly during monsoon months, which starts in the middle of June and lasts until middle of September. About 80 percent of annual rainfall occurs in this period. The other rainfall period is the pre-monsoon months from March to May.

The highest average monthly flow occurs in from July to August. This corresponds to the monsoon rainfall, which starts from middle of June and last around middle of September.

Flow in the months after monsoon period is higher than that in the pre- monsoon months. Kodku Reservoir is situated about 10 km south of Kathmandu City. This basin is located in the Lalitpur district, Bagmati Zone. Nakhu Khola bound the basin on the east and south, Manohara River on the north, and Godawari Khola on the West. In the catchment area, the land is cultivated with paddy rice, wheat and vegetables extending from terrace up the mild slope of the upstream mountain. The drainage area at the proposed dam site is about 16.5 sq. km. The rainfall data collected form rain gauge stations (Khumaltar1029,

Godawari 102294, Kathmandu Airport, 103093) were analyzed for determining different hydrological relationships. Rainfall data analysis provides an estimate of future rainfall trend that determines the rainfall intensity and occurrence of flood producing storms.

The maximum rainfall occurs in Kathmandu in around the month of June and July. 70% of flow in the Kathmandu valley occurs in monsoon months, which is from June through September. Flow in the months after monsoon period is higher than that in the pre-monsoon months. The mean annual flow at the Dam site is 0.384 m^3/s. The intensity of the maximum rainfall in a day of each year falls in the heavy category.

THE QUALITY OF WATER

About 6 samples were collected from the different location through out the river.

The important parameters analyzed were as follows:

Turbidiry

For Kodku Khola, less than 20 NTU of **turbidity** was found in the water, but turbidity was expected to reach 200 NTU during the monsoon season for Kodku Khola. Therefore, it would be necessary to provide treatment process for reducing turbidity, in order to conform with WHO‘s guideline.

Hardness

From the Kodku water sampling, total hardness values in terms of $CaCO_3$ ranged between 100-124 mg/l. This could be classified lightly as hard water. It is believed that little changes would occur during monsoon season.

Alkalinity

The water contains sodium bicarbonate alkalinity, which does not affect the total hardness. No limits have been set for alkalinity level, although high concentration of sodium bicarbonate could give rise to a taste problem.

Chloride

Most rivers and lakes contain chloride concentrations of less than 50 mg/l. Any noticeable increase in the chloride concentration of a water body is indicative of possible pollution. It could be caused by sewerage, industrial effluent or from agricultural and irrigation discharges. Water from this source in this study contained low level of chloride contents concentration during the low flow season

Phosphate

The concentration found was 0.1 mg/l which was rather small. It was expected to be higher in the monsoon season.

Table 1 WHO Guidelines for Drinking Water Quality

Parameter	Unit	Guideline Value
Microbiological Quality		
Faecal coliforms	Number/100 ml	Zero
Coliform organisms	Number/100 ml	Zero
Inorganic Constituents		
Arsenic	Mg/1	0.05
Cadmium	Mg/1	0.005
Chromium	Mg/1	0.05
Cyanide	Mg/1	0.1
Fluoride	Mg/1	1.5
Lead	Mg/1	0.05
Mercury	Mg/1	0.001
Nitrate	Mg/1(N)	10
Selenium	Mg/1	0.01
Aesthetic Quality		
Aluminum	Mg/1	0.2
Chloride	Mg/1	250
Color	True colour Unit (TCU)	15
Copper	Mg/1	1.0
Hardness	Mg/1(as $CaCo_1$)	500
Iron	Mg/1	0.3
Manganese	Mg/1	0.3
PH		6.5 to 8.5
Sodium	Mg/1	200
Solids (total dissolved)	Mg/1	1000
Sulphate	Mg/1	400
Taste and Odor	Mg/1	Inoffensive to most consumer
Turbidity	NTU	5
Zinc	Mg/1	5.0

Table 2 Water Quality Analysis Result (KWSP, 1994)

S.N.	Parameters	Unit	Result	Normal level
1	Appearance		hazy	
2	Turbidity	NTU	15	(5-25)
3	Colour	^{o}Hazen	10	5-50)
4	Temperature	^{o}C	20^{o} C	
5	P^{H}		6.8	(6.5-9.2)
6	Electrical Conductivity	US/mS/cm	206	(400-1250)
7	Total Alkalinity	as $CaCo_3$	91	
8	P.P.H Alkalinity	as $CaCo_3$		
9	P^{H} 4.5 Alkalinity	as $CaCo_3$	148.0	
10	Total Hardness	as $CaCo_3$	126.48	(100-500)
11	Calcium Hardness	as $CaCo_3$	91.80	
12	Magnesium Hardness	as $CaCo_3$	34.68	
13	Calcium	as Ca	36.75	(75-200)
14	Magnesium	as mg.	8.42	(<30-150)
15	Total Iron	as Fe.	0.65	(0.1-1)
16	Manganese	as Mn.	0.01	(0.05-0.5)
17	Silica	as Sio_2	24	
18	Total Ammonia	as N.	0.03	(0.05-1.5)
19	Nitrite	as N		
20	Nitrate	as N		(upto 10)
21	Orthophosphate	as P.		
22	Chloride	as Cl.	7.68	(up to 250)

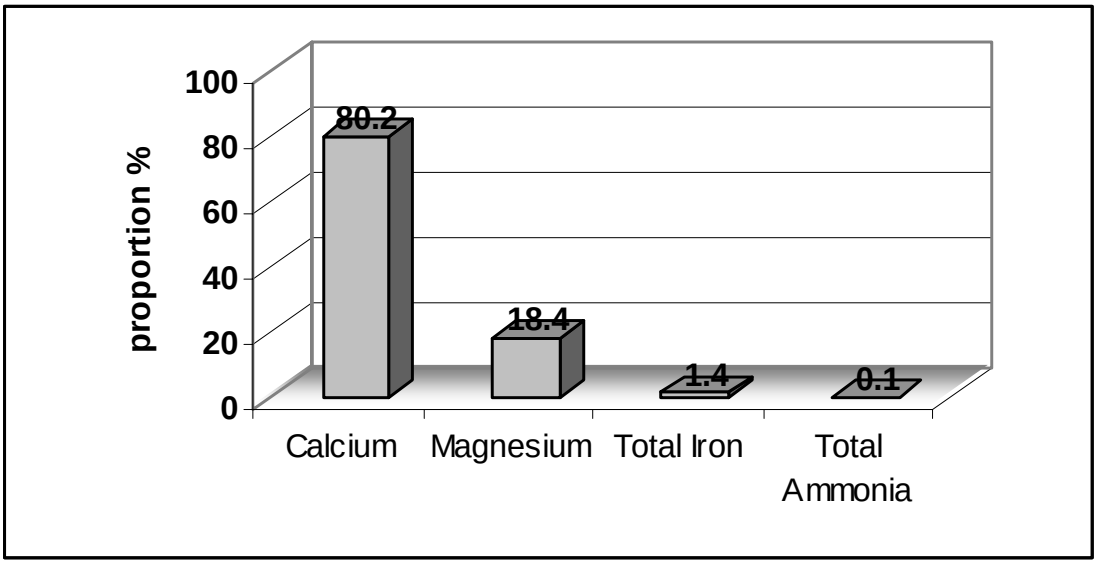


Fig 1 Bar Diagram of result of the Water Quality Test

Results of the Water Quality Test

Table 3 Different Parameters of Sample L1

Report on Chemical Analysis of water

Source of sample: Kodku Khola

Location of sample L1

S.N.	Parameters	Unit	Result	Normal level
1	Appearance		Clear	
2	Turbidity	NTU	<5	(5-25)
3	Colour	^{o}Hazen	<5	5-50)
4	Temperature	^{o}C	17^{o} C	
5	P^{H}		7.68	(6.5-9.2)
6	Electrical Conductivity	US/mS/cm	163.0	(400-1250)
7	Total Alkalinity	as $CaCo_3$	106.0	
8	P.P.H Alkalinity	as $CaCo_3$	Nil	
9	P^{H} 4.5 Alkalinity	as $CaCo_3$	148.0	
10	Total Hardness	as $CaCo_3$	110.0	(100-500)
11	Calcium Hardness	as $CaCo_3$	68.0	
12	Magnesium Hardness	as $CaCo_3$	42.0	
13	Calcium	as Ca	27.22	(75-200)
14	Magnesium	as mg.	10.20	(<30-150)
15	Total Iron	as Fe.	0.5	(0.1-1)
16	Manganese	as Mn.		(0.05-0.5)
17	Silica	as Sio_2		
18	Total Ammonia	as N.	0.02	(0.05-1.5)
19	Nitrite	as N		
20	Nitrate	as N		(upto 10)
21	Orthophosphate	as P		
22	Chloride	as Cl	8.0	(up to 250)

Note: The above values are expressed as mg/l, unless otherwise specified and except P^{H}.

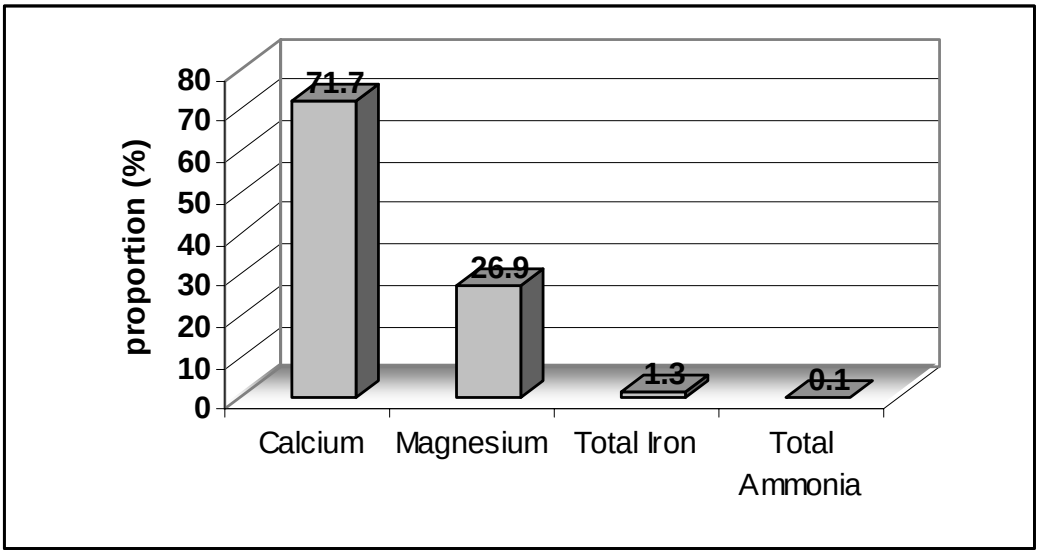


Fig 2 Bar Diagram of result of the Water Quality Test (Sample No L1)

Table 4 Differrent Parameters of Sample L2

Report on Chemical Analysis of water

Source of sample: Kodku Khola

Location of sample L2

S.N.	Parameters	Unit	Result	Normal level
1	Appearance		Clear	
2	Turbidity	NTU	<5	(5-25)
3	Colour	^{o}Hazen	<5	5-50)
4	Temperature	^{o}C	18^{o} C	
5	P^{H}		7.66	(6.5-9.2)
6	Electrical Conductivity	US/mS/cm	165.5	(400-1250)
7	Total Alkalinity	as $CaCo_3$	106.0	
8	P.P.H Alkalinity	as $CaCo_3$	Nil	
9	P^{H} 4.5 Alkalinity	as $CaCo_3$	148.0	
10	Total Hardness	as $CaCo_3$	110.0	(100-500)
11	Calcium Hardness	as $CaCo_3$	68.0	
12	Magnesium Hardness	as $CaCo_3$	42.0	
13	Calcium	as Ca	27.29	(75-200)
14	Magnesium	as mg.	12.20	(<30-150)
15	Total Iron	as Fe.	0.6	(0.1-1)
16	Manganese	as Mn.		(0.05-0.5)
17	Silica	as Sio_2		
18	Total Ammonia	as N.	0.03	(0.05-1.5)
19	Nitrite	as N		
20	Nitrate	as N		(upto 10)
21	Orthophosphate	as P.		
22	Chloride	as Cl.	10.0	(up to 250)

Note: The above values are expressed as mg/l, unless otherwise specified and except p^{H}.

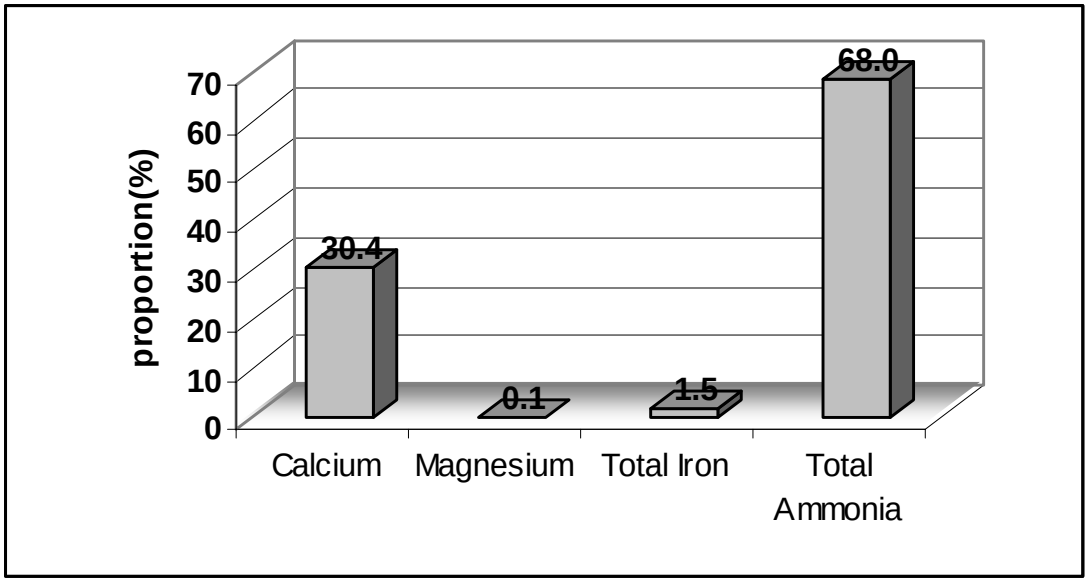


Fig. 3 Bar Diagram of result of the Water Quality Test (Sample No L2)

Table 5 Different Parameters of Sample L3

Report on Chemical Analysis of water

Source of sample: Kodku Khola

Location of sample L3

S.N.	Parameters	Unit	Result	Normal level
1	Appearance		Clear	
2	Turbidity	NTU	<5	(5-25)
3	Colour	^{o}Hazen	<5	5-50)
4	Temperature	^{o}C	17^{o} C	
5	P^{H}		7.68	(6.5-9.2)
6	Electrical Conductivity	US/mS/cm	164.0	(400-1250)
7	Total Alkalinity	as $CaCo_3$	106.0	
8	P.P.H Alkalinity	as $CaCo_3$	Nil	
9	P^{H} 4.5 Alkalinity	as $CaCo_3$	148.0	
10	Total Hardness	as $CaCo_3$	108.0	(100-500)
11	Calcium Hardness	as $CaCo_3$	67.0	
12	Magnesium Hardness	as $CaCo_3$	41.0	
13	Calcium	as Ca	27.30	(75-200)
14	Magnesium	as mg.	11.20	(<30-150)
15	Total Iron	as Fe.	0.4	(0.1-1)
16	Manganese	as Mn.		(0.05-0.5)
17	Silica	as Sio_2		
18	Total Ammonia	as N.	0.03	(0.05-1.5)
19	Nitrite	as N		
20	Nitrate	as N		(upto 10)
21	Orthophosphate	as P.		
22	Chloride	as Cl.	8.0	(up to 250)

Note: The above values are expressed as mg/l, unless otherwise specified and except P^{H}.

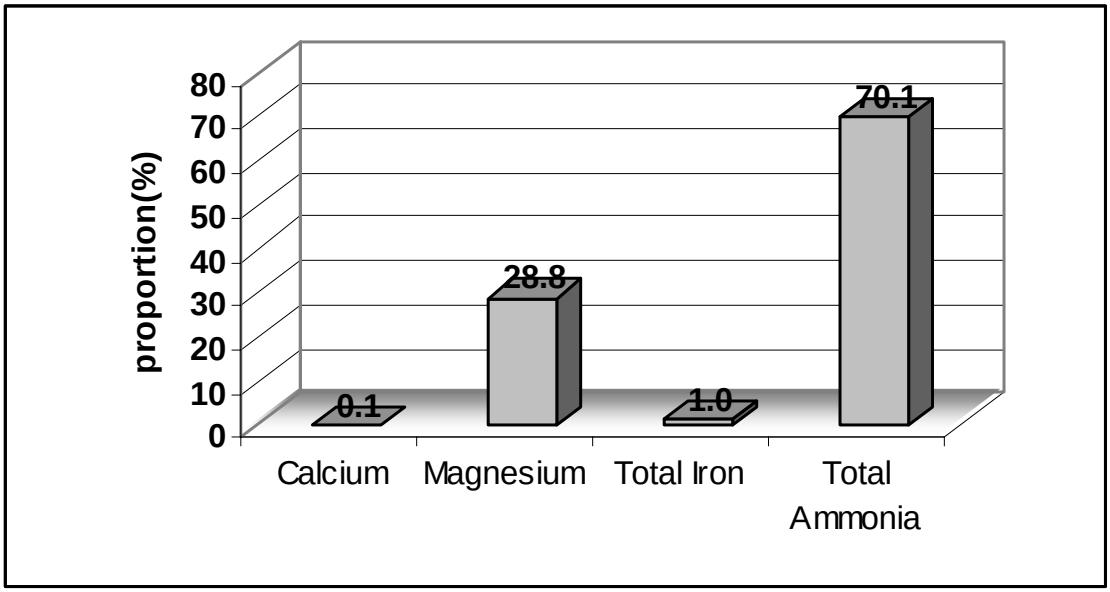


Fig.4 Bar Diagram of result of the Water Quality Test (Sample No L3)

Table 6 Differrent Parameters of Sample L4

Report on Chemical Analysis of water

Source of sample: Kodku Khola

Location of sample L4

S.N.	Parameters	Unit	Result	Normal level
1	Appearance		Clear	
2	Turbidity	NTU	<5	(5-25)
3	Colour	^{o}Hazen	<5	5-50)
4	Temperature	^{o}C	17^{o} C	
5	P^{H}		7.68	(6.5-9.2)
6	Electrical Conductivity	US/mS/cm	163.0	(400-1250)
7	Total Alkalinity	as $CaCo_3$	106.0	
8	P.P.H Alkalinity	as $CaCo_3$	Nil	
9	P^{H} 4.5 Alkalinity	as $CaCo_3$	148.0	
10	Total Hardness	as $CaCo_3$	110.0	(100-500)
11	Calcium Hardness	as $CaCo_3$	68.0	
12	Magnesium Hardness	as $CaCo_3$	42.0	
13	Calcium	as Ca	28.12	(75-200)
14	Magnesium	as mg.	12.25	(<30-150)
15	Total Iron	as Fe.	0.5	(0.1-1)
16	Manganese	as Mn.		(0.05-0.5)
17	Silica	as Sio_2		
18	Total Ammonia	as N.	0.03	(0.05-1.5)
19	Nitrite	as N		
20	Nitrate	as N		(upto 10)
21	Orthophosphate	as P.		
22	Chloride	as Cl.	10.0	(up to 250)

Note: The above values are expressed as mg/l, unless otherwise specified and except P^{H}.

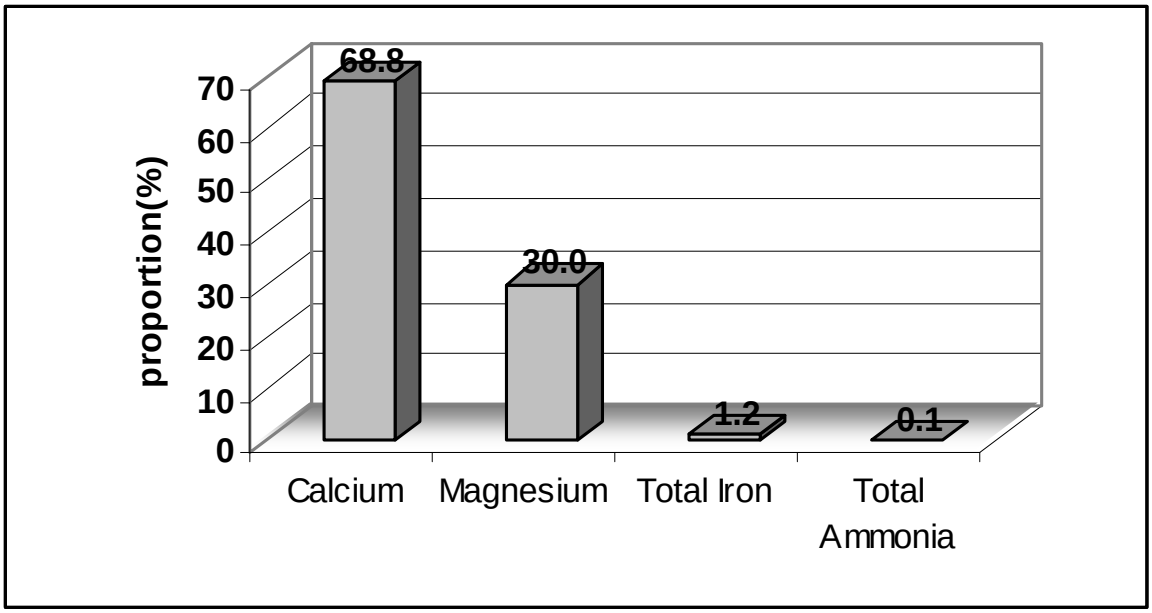


Fig. 5 Bar Diagram of result of the Water Quality Test (sample no L4)

Discussion and Conclusions

From the test results, it is very clear that the quality of the Kodku River is reasonably good. Some water quality parameters can be improved by reservoir physical, chemical and biochemical processes. The study and analysis of existing water quality from each source are essential to predict the after-storage quality, as well as the selection of water treatment processes.

Previous studies showed presence of some pesticides in rainwater. However, it was uncertain whether the discharge of these pesticides found at the proposed reservoir site was caused by percolation and runoffs from those surrounding agricultural areas. However, the reservoir itself could also act as a degrader to these pesticides.

Some pesticides are also used in the surrounding area of the dam site. Generally, during peak agricultural seasons, the farmers use pesticides and insecticides after paddy transplanting in July. Most of the chemicals used are of chlorinated hydrocarbon such as aldrin and organo- phosphorous compounds such as parathion and malathiou. Normally, only little amount is applied.

However the quality of inflow water can be improved by natural purification processes, such as reduction of pathogenic organisms, reduction of suspended matters, increase of oxygen level, decrease of carbon dioxide and hardness, oxidation of dissolved impurities such as ammonia, biodegradable organic matters.

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