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"REPERCUSSION OF DIFFERENT SALTS ON THE PROCESS OF ICE MELTING AND THEIR SEQUEL ON THE WATER QUALITY PARAMETERS THEREOF"

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Abstract- *As water is precious resource for sustaining life on earth, hence quality of water must be highly maintained so that water is fit for drinking purposes and the aquatic life residing inside water body possess no risk on their survival. During winter in Kashmir-India, the surface of earth gets covered by white patches that we call it snow, which creates an immense problem for the life on earth due to its increment in death rate. The roads covered by snow create risk for the people to walk over them and traffic movement is totally reduced until the roads get cleared. In order to get rid of from such a harsh condition, Govt. of Kashmir use rock-salt for melting ice (snow) from roads. When salt is applied over the Ice stricken roads, exothermic reaction takes place because of solvation process and the ice starts to melt. This salted water percolate over the surface of water and joins different water bodies particularly the river Jhelum and affects the water quality thereby. This study mainly focuses on the determination of the effects of different salts on the ice melting process and their individual effects on the water quality parameters. Different tests were conducted on the virgin water sample and on salt-applied water samples to evaluate the respective effects.*

Key Words: Snow, Common Salt, Rock Salt, Calcium Acetate Hydrate, Potassium Acetate, Hardness, Alkalinity.

1. INTRODUCTION

During winter in Kashmir, India – due to snowfall, roads get blocked causing a severe threat to life as the movement is restricted. People face immense problem which lead to an increase in mortality rate. In order to overcome such a circumstance, Govt. of Kashmir use rock-salt over the snow covering roads, so that ice melts, roads get cleared and the problem faced is reduced. Since, salt makes it stiff for a water molecule to stick on one another, hence, in water salt is a salute and it will break into its elements. When salt is added to ice, temperature drops from freezing point or 0°C to -21°C because positive and negative ions of salt disturb the network of hydrogen bonding. As a result, freezing point of the solution is reduced; this concept is called as "freezing point depression".

When salt is added to ice (snow), during its initial decomposition, heat is absorbed irrespective of the hydration process which is an exothermic reaction. Ice in contact with salty water melts which leads to an increase in the amount of liquid water which further help in dissolving more salt, hence, more ice to melt. If more salt concentration is dissolved, freezing point drops to a great extent. If the temperature is below 0°F, salt fails to melt ice; hence, required amount of salt is used to melt ice (snow) from the roads.

Now, the salted water after completion of melting process of snow from roads percolates over the surface of earth, joins sideway drains, streams and finally large water bodies mainly river Jhelum in Kashmir. Due to this salted water, the water quality parameters and the aquatic life of river Jhelum get dramatically changed. If the concentration of salt inside water body increases, there is a substantial change in the water quality parameters because of which water becomes unfit for drinking purposes as high salt intake leads to high blood pressure which in turn cause heart diseases, kidney failures and other health risk problems. Also cause a life risk threat to various aquatic organisms, even some die. Hence, in order to get the better of, a new salt is analyzed for melting ice during winter in Kashmir which does not disturb the water quality parameters and also not prone a threat to aquatic life thereof. Mostly, the salt suited best for melting ice.

2. TEST METHADOLOGY

Various tests were performed on virgin water sample collected from river Jhelum in Kashmir at room temperature of 25°C so as to determine the water quality parameters and the readings during test procedure were recorded. After test on virgin water sample, 850ml of

virgin water sample was taken in four different treys of 2 litres capacity each. The treys with virgin water sample were kept in a freezer for about 13 hours so as to freeze the water sample. Now, the temperature of the ice blocks was measured using digital thermometer and was equal to -5°C. After this, 100g of each salt was weighed and applied to separate ice blocks within the trey. Different salts as SODIUM CHLORIDE, ROCK SALT, CALCIUM ACETATE HYDRATE and POTASSIUM ACETATE took different time to melt ice blocks of same volume and also the temperature of salted water was recorded soon after the ice blocks got fully melted. Again the same tests were preceded on different salted water treys as were performed on virgin water sample.

Fig-1: Frozen ice and different salts applied on ice

Fig-2: Rock salt

3. RESULTS:

The results and inferences obtained are mentioned here under:-

S.NO	TYPE OF TESTS	VIRGIN WATER SAMPLE	NACL (TATA SALT)	ROCK SALT	CALCIUM ACETATE HYDRATE	POTASSIUM ACETATE
1.	Time Taken By Salt To Melt Ice	0	2 Hours	2 Hour 3 Minutes	2 Hour 5 Minutes	2 Hour 25 Minutes
2.	Source	RIVER JHELUM	BANGALURU KARNATAKA	PAKISTANI, PUNJAB	PALGHAR, MAHARASTRA	NASHIK, MAHARASTRA
3.	pH	9	9	8	9	9
4.	Temperature (°C)	24.9	7.1	5.4	10.6	10.6
5.	Calcium-Hardness (ppm)	125 130 120 Avg.=125	200 200 200 Avg.=200	280 275 285 Avg.=280	660 655 650 Avg.=655	775 775 775 Avg.=775
6.	Hardness (ppm)	140 155 150 Avg.=148	135 140 135 Avg.=137	370 380 400 Avg.=383	155 160 160 Avg.=158	1000 1000 995 Avg.=998

7.	Fluoride Content (ppm)	0.5 1 1 Avg.=0.83	0.5 1 1 Avg.=0.83	Absent	Absent	Absent
8.	Alkalinity (ppm)	100 110 100 Avg.=103	185 190 195 Avg.=190	125 125 130 Avg.=127	360 350 345 Avg.=352	2900 2980 2950 Avg.=2959
9.	Iron (ppm)	0.3 0.3 0.3 Avg.=0.3	0.3 0.3 0.3 Avg.=0.3	ABSENT	ABSENT	ABSENT
10.	Nitrate (ppm)	5 5 5 Avg.= 5	5 5 5 Avg.= 5	50 50 50 Avg.= 50	10 10 10 Avg.= 10	5 5 5 Avg.= 5

3.1 Graphical Representation Of Above Results:

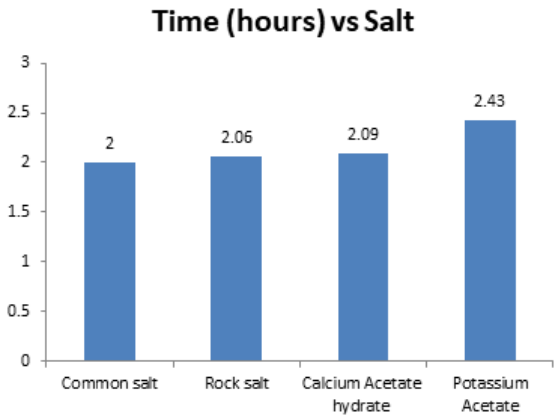

Chart-1: Time taken by different salts to melt ice

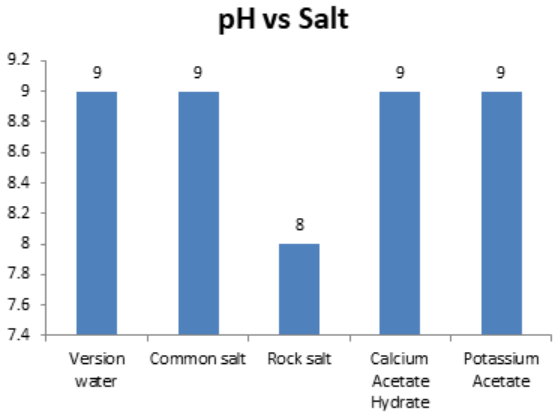

Chart-2: Effect on pH

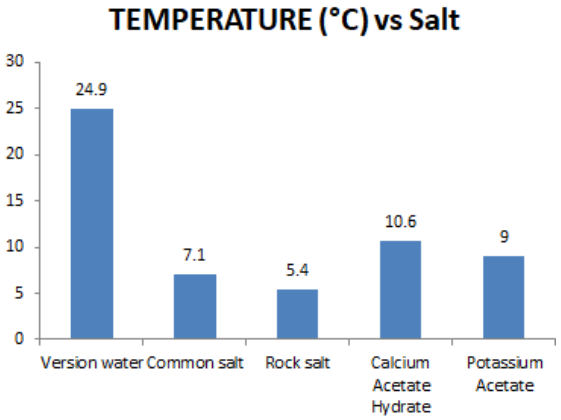

Chart-3: Effect on temperature (ppm)

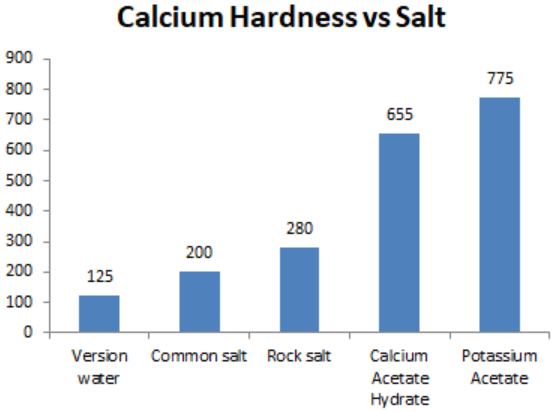

Chart-4: Effect on calcium hardness (ppm)

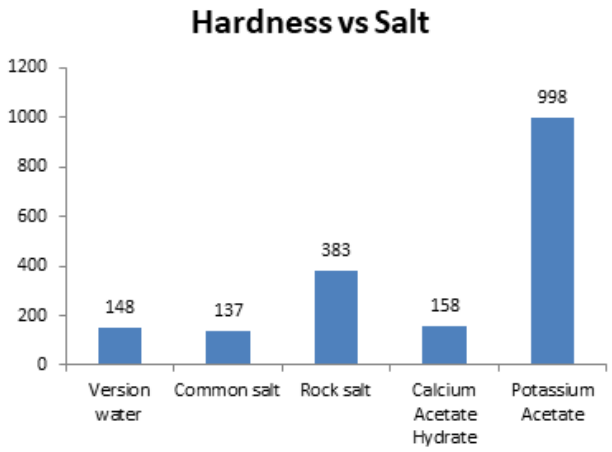

Chart-5: Effect on hardness (ppm)

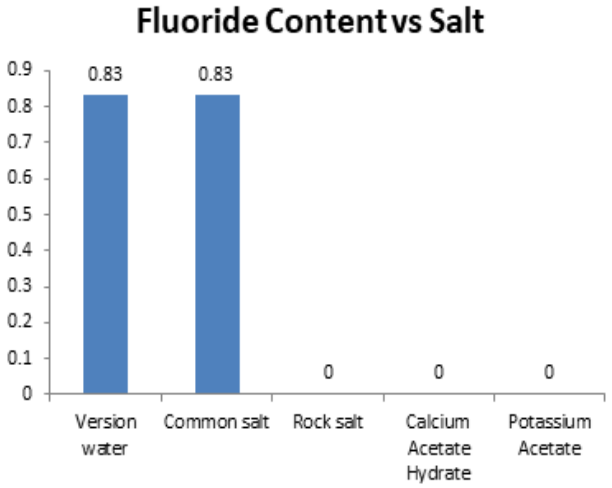

Chart-6: Effect on fluoride content (ppm)

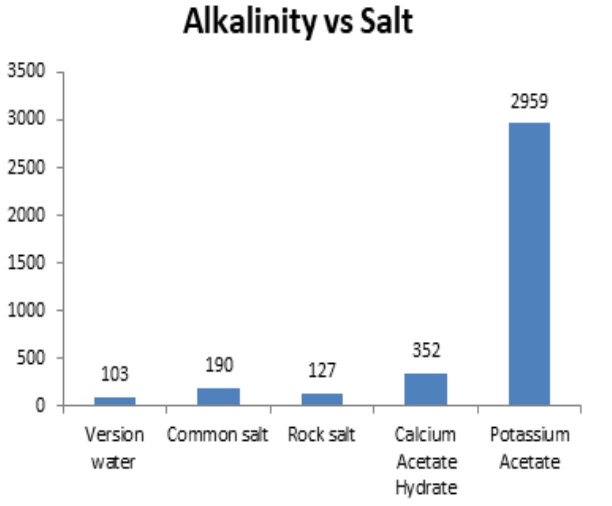

Chart-7: Effect on alkalinity (ppm)

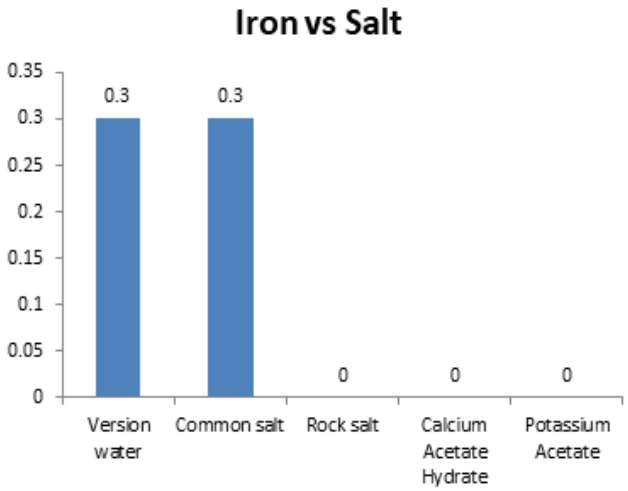

Chart-8: Effect on iron (ppm)

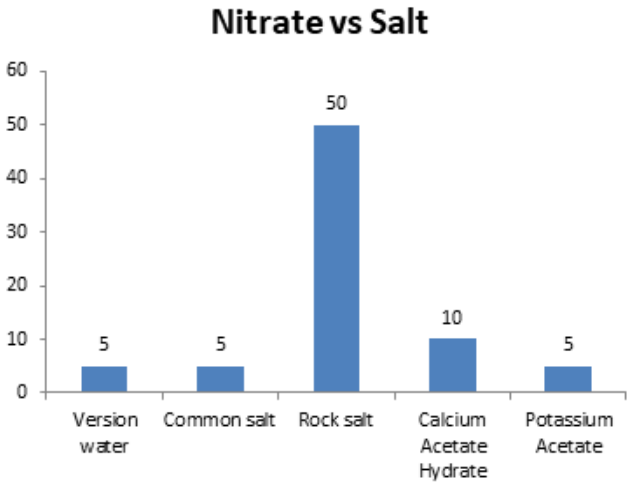

Chart-9: Effect on nitrate (ppm)

4. CONCLUSIONS

The conclusions drawn from the study and recommendations are jotted down as:

- Temperature of ice blocks was measured and found equal to -5°C.
- Calcium hardness of water should be within the range of 200 to 400 mg/l but as the tests were performed on salted ice water, NaCl and Rock salt maintained the required range of calcium hardness.
- The hardness of water when applied by different salts displaces from the normal range of 0 to 180

ppm but NaCl and Calcium Acetate Hydrate sustained the required value of water hardness.

- Fluoride content of water should be within the scope of 0.7 to 1.2 ppm. It was only NaCl salt which kept in existence the required range.

- Safe value of alkalinity of water is 20 to 200 ppm. As different salts were applied to melt ice, NaCl and Rock salt sustained the esteemed range.

- Iron best suited for water is 0.3 ppm. When salts were applied to melt ice blocks, it was only NaCl salt which kept in the range of 0.3 ppm.

- Nitrate level of water should be within the limit of 3 to 10 ppm. Among all the salts used to melt ice, NaCl, Calcium Acetate Hydrate and Potassium acetate maintained the required level.

Thus, in general, it was only NaCl salt that must be used to melt ice in Kashmir during winter because of its ability to melt snow at a faster rate and also it mostly helps to maintain the water quality parameters and does not affect the aquatic life thereof.

5. FURTHER SCOPE AREAS

The study can be carried forward to:-

1. Check the effects of above road salts on irrigation water and crop products.

2. Determine the effects of the road salts on strength and serviceability of roads.

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