GOVERNMENT OF TAMIL NADU
WATER RESOURCES DEPARTMENT

SULPHATE IN GROUNDWATER

(TAMIL NADU, AS ON JANUARY 2008)

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(TAMIL NADU AS ON JANUARY' 2008)

Introduction

Water contains both major cations and anions. Cations consists of Calcium, Magnesium, Sodium and Potassium, whereas the anions consist of Bicarbonate, Carbonate, Sulphate, Chloride and Nitrate.

Sources of Sulphate

Sulphate (SO_4) can be found in almost all natural water. The origin of most Sulphate compounds is the oxidation of sulfite ores, the presence of shales, or the industrial wastes.

Some of the soils and rocks contain sulphate minerals. As groundwater moves through these, some of the sulphate is dissolved into the water.

Some minerals that contain Sulphate are sodium Sulphate (Glauber's salt), magnesium Sulphate (Epsom salt), and calcium Sulphate (gypsum).

Sodium Sulphate (Glauber's Salt)	Magnesium Sulphate (Epsom Salt)	Calcium Sulphate (Gypsum)
		

Sulphate is one of the major dissolved components of rain. High concentrations of Sulphate in the water we drink can have a laxative effect when combined with calcium and magnesium, the two most common constituents of hardness. Bacteria, which attack and reduce Sulphates, form hydrogen sulfide gas (H_2S).

The maximum level of Sulphate suggested by Bureau of Indian Standards (BIS) in the Guidelines for Drinking-water Quality is 400 mg/L, whereas the desirable limit is 200 mg/L of sulphate (IS:10500,1991) in water intended for human consumption.

Health Risks

For humans who drink water containing high Sulphate level

People not used to drinking water with high levels of Sulphate can experience dehydration and diarrhea. Kids are often more sensitive to Sulphate than adults. **As a safety measure, water with a Sulphate level exceeding 400 mg/l should not be used in the preparation of baby food.** Older children and adults become used to high Sulphate levels after a few days

Animals

Animals are also sensitive to high levels of Sulphate. In young animals, high levels may cause severe, chronic diarrhea, and in some cases, death. As with humans, animals tend to become used to Sulphate over time. **Diluting water high in Sulphate with water low in Sulphate can help avoid problems of diarrhea and dehydration in young animals and animals not used to drinking high Sulphate water.** The proportion of water high in Sulphate to water low in Sulphate can be progressively increased until the animals can admit the high Sulphate water.

Other problems

Sulphate gives a bitter or medicinal taste to water if it exceeds a concentration of 250 mg/L. This may make it unpleasant to drink the water.

High Sulphate levels may also be corrosive for plumbing, particularly copper piping. In areas with high Sulphate levels, it is common to use corrosion resistant plumbing

Environmental fate

Sulphates are discharged into water from mines and smelters and from kraft pulp and paper mills, textile mills and tanneries. Sodium, potassium and magnesium sulphates are all highly soluble in water, whereas calcium and barium sulphates and many heavy metal sulphates are less soluble. Atmospheric sulphur dioxide, formed by the combustion of fossil fuels and in metallurgical roasting processes, may contribute to the sulphate content of surface waters. Sulphur trioxide, produced by the photolytic or catalytic oxidation of sulphur dioxide, combines with water vapour to form dilute sulphuric acid, which falls as “acid rain”.

Major uses

Sulphates and sulfuric acid products are used in the production of fertilizers, chemicals, dyes, glass, paper, soaps, textiles, fungicides, insecticides, astringents and emetics. They are also used in the mining, wood pulp, metal and plating industries, in sewage treatment and in leather processing. Aluminium sulphate (alum) is used as a sedimentation agent in the treatment of drinking-water. Copper sulphate has been used for the control of algae in raw and public water supplies

Construction purposes

Sulphate should not exceed the permissible limit of 400 mg/L as laid down by the Bureau of Indian Standards (IS:456 - 2000) for construction purposes.

METHODOLOGY

In this state water quality is being monitored in 1222 observation wells and in 852 piezometers . The samples collected during January 2008 were subjected to chemical analysis and the analyses are being carried out as per standard analytical procedures.

RESULTS AND DISCUSSION

The sulphate value ranges from 0.- 4752 mg/L in the entire state of Tamil Nadu. Districtwise range and the % distribution of nitrate, and the places where sulphate concentration is more than 400 mg/L, are also given in the table for reference

Sulphate distribution has been classified into three (3) categories Viz. Good having the sulphate value less than 200 mg/L, moderate having the sulphate value between 200 – 400 mg/L and Poor having the sulphate value greater than 400 mg/L as per BIS limit.

Good quality water with sulphate value less than 200 mg/L about 86% is available in all districts in the state of Tamil Nadu.

Moderate quality water with sulphate value between 200 – 400 mg/L, about 9% is available in all districts in the state of Tamil Nadu, except Ariyalur, Kancheepuram, Kanniyakumari, Nagappattinam, Nilgiris and Tiruvarur districts.

Poor quality water with sulphate value greater than 400 mg/L about 5% is available in all the districts except Dharmapuri, Erode, Kanniyakumari, Krishnagiri, Nagappattinam, Nilgiris, Thanjavur, Tiruvarur, Vellore and Villupuram districts..

Poor quality may be due to the marine sediments in the coastal districts of Thoothukudi, Ramanathapuram, Chennai and Tiruvallur. Poor quality in Virudhunagar district may be due to the geological formations. In the remaining part may be due to the human activities.

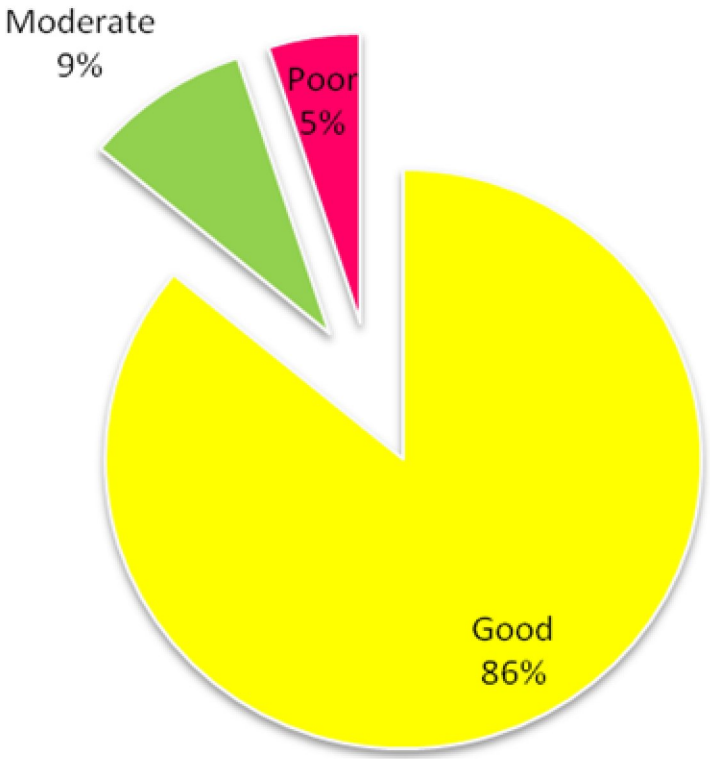
CONCLUSION

1. Sulphate in groundwater is seen in almost all the wells with exception of few wells.
2. Good quality having sulphate value less than 200 mg/L is available in all the districts of Tamil Nadu, which is about 86%.
3. Moderate quality having sulphate value between 200 – 400 mg/L, about 9% is available in all the districts except Ariyalur, Kancheepuram, Kanniyakumari, Nagappattinam, Nilgiris and Tiruvarur
4. Poor quality having sulphate value greater than 400 mg/L, about 5% is available in all the districts except Dharmapuri, Erode, Kanniyakumari, Krishnagiri, Nagappattinam, Nilgiris, Thanjavur, Tiruvarur, Vellore and Villupuram district.
5. Poor quality may be due to the marine sediments in the coastal districts of Thoothukudi, Ramanathapuram, Chennai and Tiruvallur
6. Poor quality in Virudhunagar district may be due to the geological formations.
7. In the remaining part may be due to the human activities.

DISTRICTWISE DISTRIBUTION OF SULPHATE IN TAMIL NADU

District		Percentage Distribution of Sulphate Concentration		
	Range mg/L	Good < 200 mg/L	Moderate 200 - 400 mg/L	Poor > 400 mg/L
Ariyalur	8 – 643	95	0	5
Chennai	20 – 4752	75	13	12
Coimbatore	2 – 576	88	8	4
Cuddalore	3 – 1872	93	2	5
Dharmapuri	14 – 240	97	3	0
Dindigul	1 – 576	90	6	4
Erode	10 – 398	89	10	0
Kancheepuram	0 – 922	99	0	1
Kanyakumari	1 – 137	100	0	0
Karur	15 – 1008	71	26	3
Krishnagiri	24 – 240	91	9	0
Madurai	2 – 653	85	11	4
Nagapattinam	5 – 144	100	0	0
Namakkal	15 – 1056	70	23	7
Nilgiris	1 – 82	100	0	0
Perambalur	22 – 960	85	10	5
Pudukkottai	2 – 960	96	2	2
Ramanathapuram	11 – 2880	55	15	30
Salem	2 – 720	84	10	6
Sivagangai	3 - 960	88	8	4
Thanjavur	5 – 230	97	3	0
Theni	8 – 595	92	4	4
Thiruchirapalli	5 – 403	90	8	2
Thoothukudi	9 – 3264	52	20	28
Tirunelveli	5 – 720	87	11	2
Tiruppur	1 – 624	83	10	7
Tiruvallur	4 – 864	80	8	12
Tiruvannamalai	9 – 432	91	8	1
Tiruvarur	6- 94	100	0	0
Vellore	7 – 292	92	8	0
Villupuram	10 – 307	93	7	0
Virudhunagar	10 – 1680	70	14	16
TAMIL NADU	0 - 4752	86	9	5

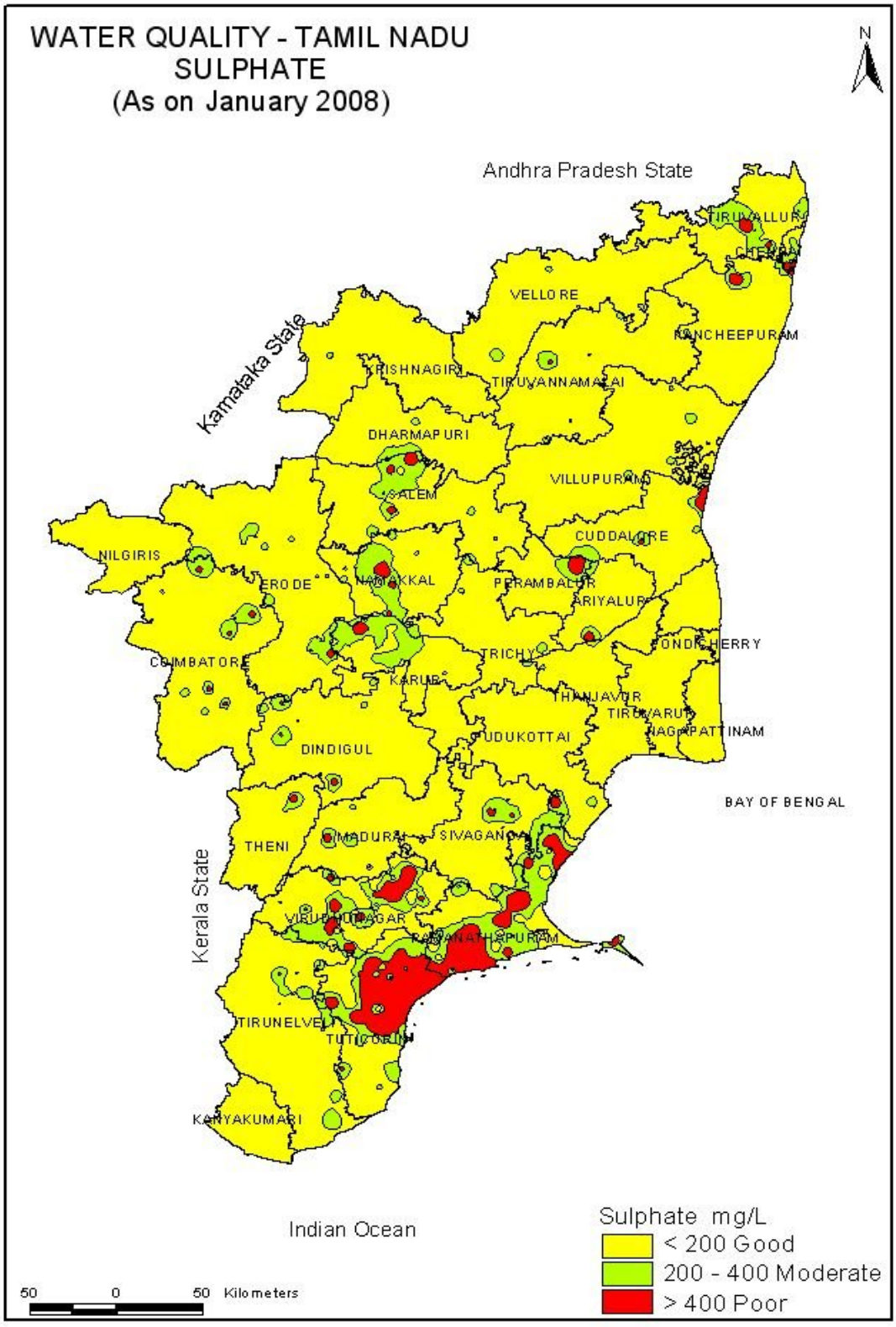
SULPHATE CONCENTRATION IN TAMIL NADU AS ON JANUARY, 2008



DISTRICTWISE DISTRIBUTION OF SULPHATE (> 400 mg/L) IN TAMIL NADU

District	Taluk	Well No	Village	SO4 mg/L
Ariyalur	Ariyalur	13014D	Sulangudi	643
Chennai	Mylapo Tiruvallikeni	HP11928	Tharamani	4752
Coimbatore	Coimbatore North	63321	Karianur	480
	Pollachi	63705	Poosaripatti	576
Cuddalore	Cuddalore	HP31552	Cuddalore - OT	1872
	Virudhachalam	HP31545	Kammapuram	547
Dindigul	Nilakkottai	83100A	Keelakovilpatti	576
	Palani	22008D	Melkaraipatti	432
		22033D	Pappampatti	422
Kancheepuram	Sriperumbudur	HP11960	Pondur	922
Karur	Aravakurichi	73052	Kuppam	1008
Madurai	Peraiyur	83064	Thirumanickam	653
	Thirumangalam	21007D	Kallikudi	408
Namakkal	Namakkal	53615	Ernapuram	480
		53616A	Palapatty	480
	Thiruchengodu	53904	Sanarpalayam	1056
Perambalur	Kunnam	13007D	Kilumattur	960
Pudukkottai	Avudayarkoil	12045D	Madagam	960
Ramanathapuram	Mudukulathur	26010	Mudukulathur	557
		26012	Sayalkudi	2880
		83290A	Ervadi	480
		83291	Terkumukkaiur	552
	Paramakudi	26006	Parthibanur	480
		26008	Chadrakudi	1200
		26009	S.V.Mangalam	960
	Ramanathapuram	83286	Uttara Kosanmangai	427
	Rameswaram	83149A	Rameswaram	432
	Thiruvadanai	26003	Pandukudi	960
		26004	Ayangudi	480
		83140C	Thondi	1056
Salem	Omalur	53703	Lokkur	576
		53704	Theevattipatti	576
		53708A	Omalur	422
	Salem	HP1S11	Vedukattampatti	720
Sivagangai	Karaikudi	24020	Visalayankottai	442
		83163	Sembanur	960
Theni	Periyakulam	23007D	Gullapuram	595
Thiruchirapalli	Thiruchirapalli	73092A	Melaarasangudi	403

District	Taluk	Well No	Village	SO4 mg/L
Thoothukudi	Kovilpatti	28003D	Kayathar	672
		93008A	Ettayapuram	960
	Ottapidaram	28002D	Eppodumventran	2400
		28013D	Pasuvandanai	624
		28014D	Puthiyamputhur	470
		28019D	Vallinayagipuram	960
		93020A	Maniyachi	720
	Srivaikundam	28025D	Cherakulam	564
	Thoothukudi	28024D	Melathattaparai	960
	Vilathikulam	28007D	Kulathur-terkku	3264
		28008D	Marthandampatti	2400
		28010D	Nagalapuram	422
		93112	T.Duraisamypuram	504
		93137	Kaluhachalapuram	432
Tirunelveli	Sankarankovil	27030D	Naduvakuruchi	720
	Tirunelveli	93092	Sankarnagar	595
Tiruppur	Dharapuram	63531	Dayampalayam	446
		HP2E28	Orathupalayam	624
	Palladam	HP2CBE16	K.Ayyampalayam	432
	Tiruppur	HP2CBE19	Veerapandi	480
	Udumalpet	63810	Chinnapoolankinar	480
Tiruvallur	Ponneri	HP11944	Kalpakkam	418
		HP11946	Koranjur	403
	Poonamalli	HP11941	Avadi	552
	Tiruvallur	13031	Nandhimangalam	403
		13074A	Komagambedu	403
		13104	Karikalavakkam	864
Tiruvannamalai	Polur	HP21520	Veeralur	432
Virudhunagar	Aruppukottai	25014D	Kovilankulam	1680
		25030	P.Pudupatti	780
		83207A	Palavanatham	701
		83224	Sriramboor	768
	Sattur	25028	Gananjampatty	960
		83115	Vembakottai	509
		83201A	Pulvoypatti	835
	Srivilliputhur	25004M	Vadugapatti	624
		83184	Perumalthevanpatti	432
	Thiruchuli	83218	Panaiyur	480
	Virudhunagar	83187B	Vellaihpuram	768
		83200A	Naduvapatti	864


WATER QUALITY - TAMIL NADU
SULPHATE
(As on January 2008)
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Andhra Pradesh State
Karnataka State
Kerala State
VELLORE
KANCHEEPURAM
KRISHNAGIRI
TIRUVANNAMALAI
DHARMAPURI
SALEM
VILLUPURAM
CUDDALORE
NILGIRIS
ERODE
NAMAKKAL
PERAMBALUR
ARIYALUR
PONDICHERRY
COIMBATORE
KARUR
TRICHY
THANJAVUR
NAGAPATTINAM
DINDIGUL
PUDUKOTTAI
BAY OF BENGAL
THENI
MADURAI
SIVAGANGA
RAMANATHAPURAM
TIRUNELVELI
TUTICORIN
KANYAKUMARI
Indian Ocean
Sulphate mg/L
< 200 Good
200 - 400 Moderate
> 400 Poor
50 0 50 Kilometers