SRI LANKA STANDARD 776 : 1987

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TOLERANCE LIMITS FOR
INDUSTRIAL EFFLUENTS DISCHARGED ON LAND FOR IRRIGATION PURPOSES

SRI LANKA STANDARDS INSTITUTION

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SLS 776:1987

Gr. 6

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SRI LANKA STANDARD

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FOREWORD

This Sri Lanka Standard has been authorized for adoption and publication by the Council of the Sri Lanka Standards Institution on 1987-01-07 after the draft, finalized by the Drafting Committee on Industrial Effluents, had been approved by the Chemicals Divisional Committee.

One of the modes of disposal of industrial effluents is by discharging them on agricultural lands. This mode of disposal not only avoids degradation of quality of water resources but also makes available a source of irrigation water.

Irrigation practices should be designed for maximum economical use of water; these should also depend upon water-holding capacity of soil, land topography, general climate, the particular crop etc. Such objectives are, however, seldom followed, resulting in following difficulties:

a) Concentration of various constituents which may be deleterious to crop yields;

b) Decrease of soil permeability; and

c) Increased chances of ground water contamination.

It is therefore imperative that soils on which the effluents are discharged are studied periodically from the viewpoint of physico-chemical characteristics to ensure that they are not damaged and the ground waters not polluted. Hydraulic loading rates generally applicable for different types of soils are given in Appendix A, for information and guidance.

In order to regulate disposal of effluents on land, it is necessary to limit certain constituents in effluents, especially those considered toxic, so that the effluents may comply with normally accepted irrigation water quality.

The tolerance limits prescribed in this standard are intended to guide the local authorities in framing rules regarding disposal of industrial effluents. In arriving at a decision on the tolerance limits, the authorities shall in consultation with the Central Environmental Authority (CEA), give due consideration to the local conditions and in special cases may relax the limits or make them more rigid.

Tolerance limits for colour and odour have not been prescribed in this standard but it is recommended that as far as practicable, colour and unpleasant odours should not be present in industrial effluents.

The standard values given in this standard are in SI units.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or an alalysis, shall be rounded off in accordance with **CS 102**. The number of significant places retained in this rounded off value should be the same as that of the specified value in this standard.

In the preparation of this standard the assistance obtained from the publications of the World Health Organization, the American Public Health Association and the Indian Standards Institution is gratefully acknowledged.

1 SCOPE

This standard prescribes tolerance limits and methods of sampling and test for industrial effluents discharged on land for irrigation purposes.

2 REFERENCES

APHA-AWWA-WPCF Standard methods for the examination of water and waste water

UNESCO/WHO Global environmental monitoring systems operational guide

CS 102 Presentation of numerical values

SLS 652 Tolerance limits for industrial effluents discharged into inland surface waters.

3 REQUIREMENTS

3.1 Industrial effluents, before they are discharged on land for irrigation, shall comply with the tolerance limits specified in Table 1.

TABLE 1 - Tolerance limits for industrial effluents

Determinant	Tolerance limit	Method of test (Ref. to publication in Clause 5 and relevant Appendix)	Technique of the method
1) Total dissolved solid mg/l, max.	2 100	Appendix B	—
2) pH value at ambient temperature	5.5 to 9.0	a	Electrometry, by means of pH meter with a glass electrode (Reference method)
		b	Colorimetry, Winkler (Azide modification) method
3) Biochemical oxygen demand (BOD), mg/l	250	a	Incubation for 5 days at 20 °C (Reference method)
			Incubation for 3 days at ambient temperature.
4) Oils and grease, mg/l, max.	10.0	a	Gravimetry, liquid-liquid extraction with trichloro trifluoroethane
5) Chloride (as Cl), mg/l, max.	600	a	Titrimetry-silver nitrate method (Reference method)
		a	Titrimetry-mercuric nitrate method
6) Sulfate (as SO_4), mg/l, max.	1 000	a	Gravimetric method, ignition of residue (Reference method)
		a	Turbidimetry-turbidimetric method.
7) Boron (as B), mg/l max.	2.0	a	Carmine method
8) Arsenic (as As), mg/l, max.	0.2	a	A.A. Spectrophotometric method
9) Cadmium (as Cd), mg/l, max.	2.0	a	"
10) Chromium (as Cr), mg/l, max.	1.0	a	"

Determinant	Tolerance limit	Method of test (Ref. to publication in Clause 5 and relevant Appendix)	Technique of the method
11) Lead (as Pb), mg/l, max.	1.0	a, b	Colorimetric (dithizone) method (Reference method)
		a	A.A.Sepctrophotometric method
12) Mercury, (as Hg), mg/l, max.	0.01	a	Flameless A.A. Spectrophotometric method
13) Sodium adsorption ratio: (SAR)	10 to 15	Appendix C	
14) Residual sodium carbonate, mol/l, max.	2.5	Appendix D	
15) Radio active material			
a) Alpha emitters, µc/ml	10^{-9}	a	Proportional or scintillation counter
b) Beta emitters, µc/ml	10^{-8}	a	Proportional or scintillation counter.

4 SAMPLING

Representative samples of the industrial effluents shall be obtained as prescribed in 4 of SLS 652:1984.

5 METHODS OF TEST

5.1 Samples obtained as described in 4 shall be tested for the relevant requirements of the standard as prescribed in the following publications and Appendices B, C and D.

a) American Public Health Association, American Water Works Association and Water Pollution Control Federation, Standard Methods for the Examination of Water and Waste Water; 15th ed. or latest ed., New York, APHA.

b) Global Environmental Monitoring Systems Water Operational Guide UNESCO/WHO 1978.

5.2 For certain determinants two test methods have been given in Table 1. The reference method shall be used in case of dispute.

APPENDIX A

HYDRAULIC LOADING RATES

When industrial effluents are applied on agricultural land, the hydraulic loading rates given in Table 2 are generally followed. These loading rates should also take into account the nature of crop and its water requirements, climatic conditions and frequency of application.

TABLE 2 - Hydraulic loading applicable for different soils

Soil texture	Recommended dosage of settled industrial effluents, m^3/hectare/day
i) Sandy	225 to 280
ii) Sandy loam	170 to 225
iii) Loam	110 to 170
iv) Clay loam	55 to 110
v) Clayey	35 to 55

APPENDIX B

DETERMINATION OF TOTAL DISSOLVED SOLIDS

B.1 APPARATUS

B.1.1 *Evaporating dish,* of platinum or porcelain or silica, of capacity 150-ml to 200-ml.

B.2 PROCEDURE

Dry the empty and clean evaporating dish in an oven at 103 °C to 105 °C. Cool and weigh. Repeat heating, cooling and weighing until the difference in mass between two successive weighings does not exceed 1 mg. Filter a suitable volume of the sample through a filter paper (Whatman No. 42 or equivalent). Transfer quantitatively to the previously weighed evaporating dish a volume of the filtered sample which will yield a residue between 100 mg and 250 mg. Evaporate to dryness on a steam bath. Dry the residue at 105 °C. Cool and weigh. Repeat heating, cooling and weighing until the difference in mass between two successive weighings does not exceed 1 mg.

B.3 CALCULATION

Total dissolved solids in mg/l $= 1\,000 \frac{m}{V}$

where,

m = mass, in mg, of the residue; and

V = volume, in ml, of the sample originally taken for the test.

APPENDIX C

DETERMINATION OF SODIUM ADSORPTION RATIO

C.1 Determine the concentration of sodium ions by flame photometric method given in publication (a) of 5.

C.2 Determine the concentration of calcium ions and magnesium ions by ethylene diamine tetra acetic acid (EDTA) titrimetric method given in publication (a) of 5.

C.3 Calculate the sodium adsorption ratio as follows:

$$\text{Sodium adsorption ratio (SAR)} = \frac{[Na^+]}{\sqrt{[Ca^{2+} + Mg^{2+}]}}$$

where,

$[Na^+]$ = concentration, in mol/l, of sodium ions;

$[Ca^{2+}]$ = concentration, in mol/l, of calcium ions; and

$[Mg^{2+}]$ = concentration, in mol/l, of magnesium ions.

APPENDIX D

DETERMINATION OF RESIDUAL SODIUM CARBONATE

D.1 REAGENTS

D.1.1 *Hydrochloric acid*, standard volumetric solution, c(HCl) = 0.1 mol/l

D.1.2 *Phenolphthalein indicator*, 0.1 per cent (*m/V*) solution of phenolphthalein in 50 per cent (*V/V*) solution of ethanol.

D.1.3 *Methyl orange indicator*, 0.04 per cent (*m/V*) solution of methyl orange in 20 per cent (*V/V*) solution of ethanol.

D.2 PROCEDURE

Remove any suspended matter from the sample by filtration or centrifuging. Transfer 100 ml of the sample into a 750-ml conical flask. Add a few drops of phenolphthalein indicator solution (D.1.2) and titrate with standard hydrochloric acid solution (D.1.1). Note the voluem required (V_1). To the solution neutralized to phenolphthalein add a few drops of methyl orange indicator solution (D.1.3) and titrate to the end-point. Note the volume required (V_2).

D.3 CALCULATION

Calculate the residual sodium carbonate as follows:

$$\text{Residual sodium carbonate, in mol/l} = c\,(V_1 + V_2) - \left\{ \left[\mathrm{Ca}^{2+}\right] + \left[\mathrm{Mg}^{2+}\right] \right\}$$

where,

c = concentration, in mol/l, of standard hydrochloric acid;

V_1 = volume, in ml, of the hydrochloric acid required for the titration when phenolphthalein is used as the indicator;

V_2 = volume, in ml, of the hydrochloric acid required for the titration when methyl orange is used as the indicator;

$\left[\mathrm{Ca}^{2+}\right]$ = concentration, in mol/l, of calcium ions, (see **C.2**); and

$\left[\mathrm{Mg}^{2+}\right]$ = concentration, in mol/l, of magnesium ions (see **C.2**).

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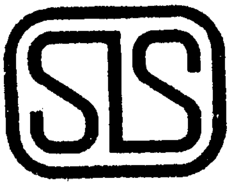

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SRI LANKA STANDARDS INSTITUTION

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