
Extraction of oil and grease in wastewater according to the Randall method

Reference: EPA 1664 n-Hexane Extractable Material by Extraction and Gravimetry

Tested with VELP Scientifica SER 158/6 Automatic Solvent Extraction (Code F303A0380)



Introduction

The oil and grease contents of domestic and certain industrial wastes and the sludge are important considerations in the handling and treatment of these materials for ultimate disposal. Knowledge of the quality and concentration of the oil and grease present is helpful in the proper design and operation of wastewater treatment systems. The term grease applies to a wide variety of organic substance that is extracted from an aqueous solution or suspension by hexane. Hydrocarbons, esters, oils, fats, waxes and high molecular weight fatty acids are the major materials dissolved by hexane. All these materials have a greasy feel and are associated with the problems in wastewater treatment related to grease.

In this case, we analyzed a Certified Reference Material (QC1083) with a known n-Hexane Extractable Material (Oil and Grease) with SER 158 Automatic Solvent Extraction unit.

Oil and grease extraction with SER158

The hot solvent extraction process with SER 158 Series can be summed up in 5 steps, for a fully automated operation:



During IMMERSION the sample is immersed in boiling solvent. Then the REMOVING step automatically lowers the level of the solvent to below the extraction thimble. During WASHING the condensed solvent flows over the sample and through the thimble to complete the extraction process. The fourth step involves solvent RECOVERY. Approximately 90% of the solvent used is collected in the internal recovery tank. The final step is the COOLING of the extraction cups containing the extracted matter. The cups are raised to prevent burning. The extraction cups containing the extract are placed in a drying oven, cooled in a desiccator and weighed for the extract percentage calculation.

Sample

QC1083 Certified Reference Material

n-Hexane Extractable Material (Oil and Grease): 71 to 116 mg/L

Chemicals and Equipment Required

- Analytical balance, min. 3 decimals
- Cellulose thimbles (33x80 mm) (Code A00000295)
- Glass extraction cups (Code A00000290)
- Paper filter (Whatman no.40 or equivalent)
- Viton seals
- Hexane
- Buchner funnel
- Flask or glass bottle

Sample Preparation

To prepare the solution, add 994 mL of reagent-grade water and 5 mL of 1:1 Hydrochloric Acid to a 2-L separatory funnel. Open ampule QC1083 and transfer 1.0 mL of concentrate to the separatory funnel. Mix well. The sample is now ready for immediate analysis. For calculations, assume that the initial sample volume was 1000 mL.

Prepare a 12 cm Buchner funnel with a disk of muslin cloth overlaid with a filter paper disk. Filter under vacuum all the solution with a standard. Filter until no more water passes the filter. Transfer the paper filter to a watch glass using forceps.

Wipe the walls and bottom of the collecting bottle and Buchner funnel with pieces of filter paper soaked in solvent and add them to the paper filter on a watch glass. Roll the paper filter and introduce it into the extraction thimble. Dry the thimble in an oven at 103°C for half an hour.

Put 100 ml of n-Hexane in the glass bottle where the sample was prepared. Heat on a heating stirring plate at 50°C until the solvent is hot enough and mix it to clean all the walls of the glass bottle. Then put all the Hexane in the glass bottle directly into the extraction cup.

Place the dried thimble with the thimble holder into the extraction cup and proceed with the analysis.

Extraction Procedure with SER 158

The extraction cups containing the thimble can now be placed on the heating plate of SER 158.

On the ControlPad select "Analysis", and then method "Oil and grease from wastewater" including the following parameters:

- Immersion Time: 60 minutes
- Removing Time: 10 minutes
- Washing Time: 50 minutes
- Recovery Time 30 minutes
- Cooling Time: 5 minutes
- n-Hexane, 100 ml

Close the safety guard and press START to begin the extraction process. At the end of analysis position the extraction cups containing the extract in a drying oven (1 hour at 80 °C), cool them in a desiccator to room temperature and record the accurate weight (M_{tot}).

Results on HEM Standards

The results have been calculated using the following equation:

$$\text{mg/L oil/fat} = (m_{\text{total}} - m_{\text{tare}}) * 100$$

m_{tare} : tare of the extraction cup [g]

m_{total} : extraction cup weight after fat extraction [g]

Where:

Tare = weight of the empty extraction cup (g)

Total = weight of the extraction cup + extract (g)

Average* extract (g) ± SD	Average* extract (mg/L) ± SD
0,108 ± 0.005	108 ± 5

Oil and grease labelled content: 71 to 116 mg/L

***3 runs**

Conclusion

The results obtained are reliable and reproducible in accordance with the expected values. Therefore, [SER 158 Solvent Automatic Solvent Extractor](#) unit is ideal for the extraction of oil and grease from wastewater.

Benefits of hot solvent extraction (Randall) by using [SER 158 Solvent Automatic Solvent Extractor](#):

- up to 5 times faster than Soxhlet (hot solvent vs. cold solvent)
- low solvent consumption (high solvent recovery, approximately 90%) - limited cost per analysis
- no exposure to solvent
- worldwide official method
- full traceability with automatic result calculation and onboard archive

In addition, connect the [SER 158 Solvent Automatic Solvent Extractor](#) to the exclusive [VELP Ermes Cloud Platform](#) to improve your laboratory experience.