

**TERMS OF REFERENCE FOR R&D PROJECT**  
**PETROLEUM, COAL, AND RELATED PRODUCTS DEPARTMENT**  
**(ORGANIC CHEMICALS, ALCOHOL AND ALLIED PRODUCTS, PCD 9)**  
*(Refer to the guidelines on R&D Projects issued vide note SCMD/R&D)*

## **1 Title**

Study of inter-conversion data of units used in the estimation of percentages of ethanol in ethanol-water mixtures.

## **2 Background**

**2.1** The volumetric content of ethanol at  $t$  °C in an ethanol-water mixture is calculated by methods like pycnometer/hydrometer and reported in various units. This interconversion data is majorly used in distilleries.

**2.2** Computation of strength of aqueous solutions containing ethanol is often made from specific gravity values in air at 15.6 °C and strength is expressed in terms of proof spirit (proof strength). The corresponding percentages of ethanol by weight, and by volume at 15.6 °C are also obtained for the various specific gravity values in air.

**2.3** There are diverse systems/units adopted by countries to express the percentage of ethanol in an ethanol-water mixture.

**2.4** Bureau of Indian Standards (BIS) has published an Indian Standard IS 5860 : 1970 Table and inter-conversion charts for ethanol-water mixtures, which states the comparison data of interrelation between various units/systems, used across the globe. IS 5860:1970 may be accessed at <https://standardsbis.bsbedge.com/>

**2.5** The data available in the IS 5860 is quite old and thus a need was felt to verify the existing data. There might be a chance that new units may have been developed to report the percentage of ethanol in ethanol-water mixture since 1970 both at national or international level.

## **3 Objective**

**3.1** To collect data and analyze the data of inter-conversion of units used by industries in the estimation of percentages of ethanol in ethanol-water mixtures.

## **4 Scope**

**4.1** Undertake extensive and thorough examination of the available literature on interconversion unit data used in estimation of percentages of ethanol in ethanol-water mixtures including international standards, if any, research papers published on the subject, any study conducted

by any organization/metrological department of any country across the globe or any other available sources.

**4.2** Identify the distilleries and collect data through circulation of questionnaire, seeking information mentioned at **4.4** and **4.5**, used to report percentages of ethanol in ethanol-water mixtures.

**4.3** In case of use of different units/system by different distilleries, the interrelation data is to be provided for the same.

**4.4** Collection of data of the interconversion of the below mentioned units for estimation of percentages of ethanol in ethanol-water mixtures keeping percentage of ethanol by volume at 15.6 °C/15.6°C as standard unit and the difference between the percentage content of ethanol by volume at 15.6 °C /15.6 to be 0.2 °C:

- *specific gravity in air at 15.6 °C /15.6 °C*
- *percentage of British proof spirit,*
- *percentage of ethanol by weight,*
- *percentage of ethanol by volume at 15.6 °C /15.6 °C*
- *percentage of US proof spirit, arid*
- *specific gravity in vacuum at 15°C /15°C*

**4.5** Collection of data of any other interconversion unit in practice at national or international level and has not been mentioned in SI No. **4.4** which is used for reporting the percentage of ethanol in ethanol-water mixture varying from 0-100 ethanol percentage content in ethanol-water mixture. The interconversion data provided for the new unit proposed should be the conversion of data of percentage of ethanol by volume at 15.6 °C /15.6 °C as standard unit and the percentage of ethanol by volume at 15.6 °C/15.6 °C should vary by 0.2 percentage.

**4.6** Comparison of the obtained results at **4.4** with existing data as mentioned in IS 5860.

## **5 Deliverables**

**5.1** Detailed report containing the following:

- a) Summary of literature survey carried out as mentioned at **4.1**.
- b) Outcomes and data obtained from literature review.
- c) Details of distilleries contacted and information obtained from them.
- d) Questioner prepared and response received from distilleries.
- e) Comparison of obtained results with the data as prescribed in IS 5860.

## **6 Research Methodology**

**6.1 Literature Review** – Undertake a comprehensive literature review as mentioned at **4.1**.

**6.2 Collection of interconversion data** of various units as mentioned at **4.4** and **4.5**, which are used in estimation of percentages of ethanol in ethanol-water mixtures.

**6.3 Comparison** of the obtained results from **4.4** with existing data as mentioned in IS 5860.

**6.4 Report** - A comprehensive report outlining the findings of the research project, as mentioned at **4**.

## **7 Timeline and Method of Progress Review**

**7.1 Project Timeline:** 3 months.

**7.2 Stages for Review:**

- **Stage I** – At the end of 4<sup>th</sup> week, submit, 1<sup>st</sup> draft report specifying the following:
  - a) Details of literature review carried out and summarized report;
  - b) Identified distilleries and
  - c) Format of questionnaire prepared for manufacturers and importers;
  
- **Stage II** – At the end of 9 week, interim report as per the scope mentioned at **4**.

Sectional Committee will review the draft report and provide recommendation changes, if any within a week.

- **Stage III** – At the end of 12 week submit the final report.

## **8 Support from BIS**

**8.1** Access of Indian and International Standards.

**8.2** The following nodal person from BIS may be contacted for any queries.

— Ms Aditi Choudhary, Scientist B/ Assistant Director, Member Secretary PCD 9

— Email Id: [pcd9@bis.gov.in](mailto:pcd9@bis.gov.in)/[pcd@bis.gov.in](mailto:pcd@bis.gov.in)