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Application Note

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Preparation of Standards – Easier than Ever with the Sartorius Cubis® MSA Dosing System

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Abstract

Preparation of standards, also called reference samples, of known concentrations is a common routine procedure in analytical laboratories. Internal or external standards with very low concentrations are used in these laboratories for highly sensitive quantitative analytical methods to exactly determine the concentration of chemical components in samples using highly sensitive quantitative analytical procedures.

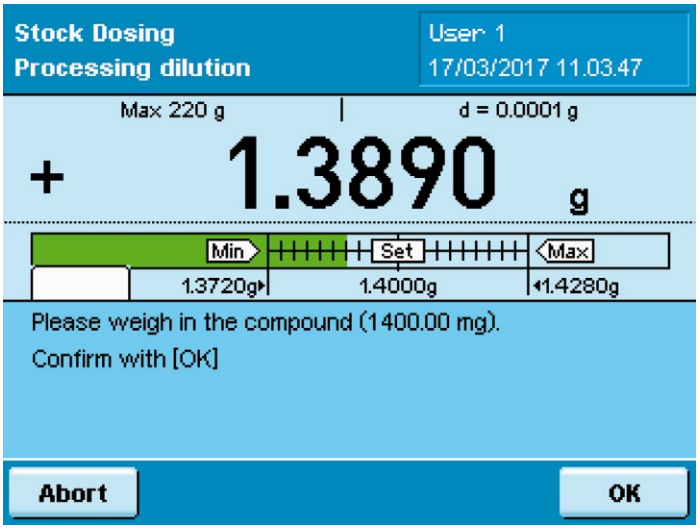
Find out more: https://www.sartorius.com/en/applications/life-science-research/sample-preparation/hplc-sample-prep

Preparation of standards of known concentrations is a common routine procedure in analytical laboratories. Internal or external standards with very low concentrations are used in these laboratories for highly sensitive quantitative analytical methods to exactly determine the concentration of chemical compounds in samples. External standards are separate samples used for comparison to test samples, whereas internal standards are added to the samples to be analyzed. Therefore, the concentration of such standards must be as accurate as possible to prevent subsequent errors in the determination of unknown concentrations of compounds in samples. Two problems can occur when standards are manually prepared from soluble solids:

1. The solvent volume required and the compound concentration desired are both used to calculate the amount of a soluble compound to be weighed. The essential problem does not lie in the calculation itself, but rather in the accuracy with which the amount of the solid is weighed according to the calculated target quantity. On high-resolution laboratory balances, it is next to impossible to weigh in a compound accurately to one µg or even less.

2. If the amount actually weighed does not precisely match the target amount calculated, the solvent quantity has to be adjusted to reach the desired final concentration. Recalculation of the required liquid volume takes up valuable time and is a potential source of error. Depending on the type of concentration specified, various parameters need to be taken into account, such as the desired concentration, purity of the substance, amount actually weighed and possibly even the molecular weight. For inexperienced users, recalculation of the compound weight is usually takes considerable time, whereas experienced users commonly find this a boring task so inadvertent errors can easily creep in.

The Cubis® MSA dosing system simplifies workflows in the preparation of standards. Once the user enters the desired concentration and volume of a standard solution, the system automatically calculates the required amount of the compound to weigh in and shows the target weight as a bar graph with the minimum and maximum tolerances:



Although the user hardly ever ends up weighing the exact amount in this case as well, the system software uses the actual weight of the compound to recalculate the volume of the solvent and transmits this value to the automatic dispenser. As a result, any variations in the amount weighed from the desired target weight will not require the user to recalculate the volume of solvent when using the Cubis® MSA dosing system. Instead, the entire workflow can progress without any interruptions and the solvent can be automatically dispensed.

After the solvent is added, the weight of the sample is determined again. In this way, the Cubis® balance verifies how much solvent was actually added. This gravimetric monitoring step is considerably more accurate than any volumetric measurement of a solvent. Volumetric measurement procedures are disadvantageous in that they do not sufficiently allow for the effects on accuracy, such as evaporation of highly volatile solvents, hold-up volume in tubing or pipettes, differences in the density of solvents, etc. By contrast, gravimetric measurement methods deliver absolute values and achieve the highest accuracy. At the end of the workflow, the dosing system software calculates the exact concentration of the standard solution.

Compared with known, fully automatic dispensing systems on the market, the product presented in this Application Note offers a number of decisive advantages. Fully automatic systems, which take care of dispensing fine powder, granules and homogeneous or heterogeneous mixtures, require exact knowledge of the dispensing properties of these substances. For example, the flowability, size, shape, compactness, density, tendency to aggregate and electrostatic properties of the particles must either be known or visually evaluated. Choosing the right dispensing head is not always easy given the many different dosing parameters that have often been only qualitatively assessed.

Beyond this, changing the equipment accessories of such a dosing system to dispense a different compound each time is time-consuming and expensive as various dispensing heads have to be purchased. It makes sense to use such systems only if a very high number of standards have to be prepared. For preparation of a low or medium number of standards, the semi-automatic system introduced in this Application Note offers higher flexibility and saves considerable time. Compelling reasons in favor of an open-design system are the lower purchase costs and, by virtue of the system's simplicity, much lower operating and maintenance costs.

Although the software of the Cubis® MSA dosing system offers the option of managing data sets of up to 100 different compounds, solvents and standards, this number may be too low for analytical laboratories that routinely prepare standards. In addition, preparation of standards is only one step in the entire analytical procedure so centralized data management that represents the entire process chain is recommended. For this purpose, the software of the Cubis® MSA dosing system has an interface for the ThermoFisher Chromeleon™* 7.2 SR4 chromatography data system that is designed to manage chromatographic systems and perform data analysis.

In the Chromeleon component table, the user defines the desired concentration of standard samples:

Detection | Component Table | Calibration | Unidentified Peak Group Table | Chromatogram Subtraction | Advanced Settings | SST/IRC

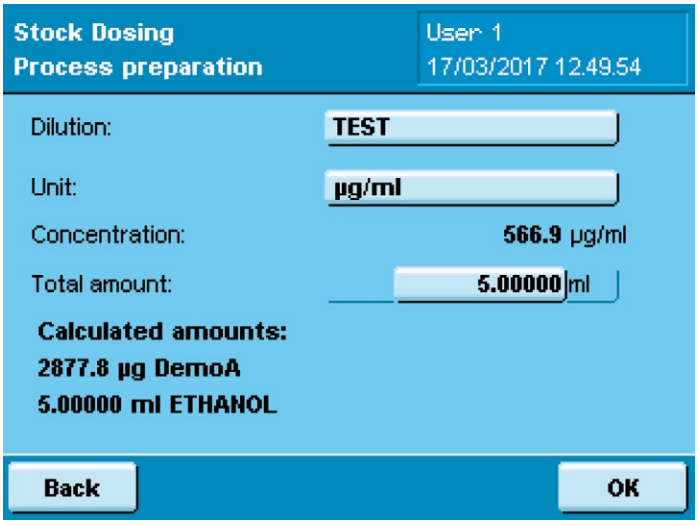
Component Table

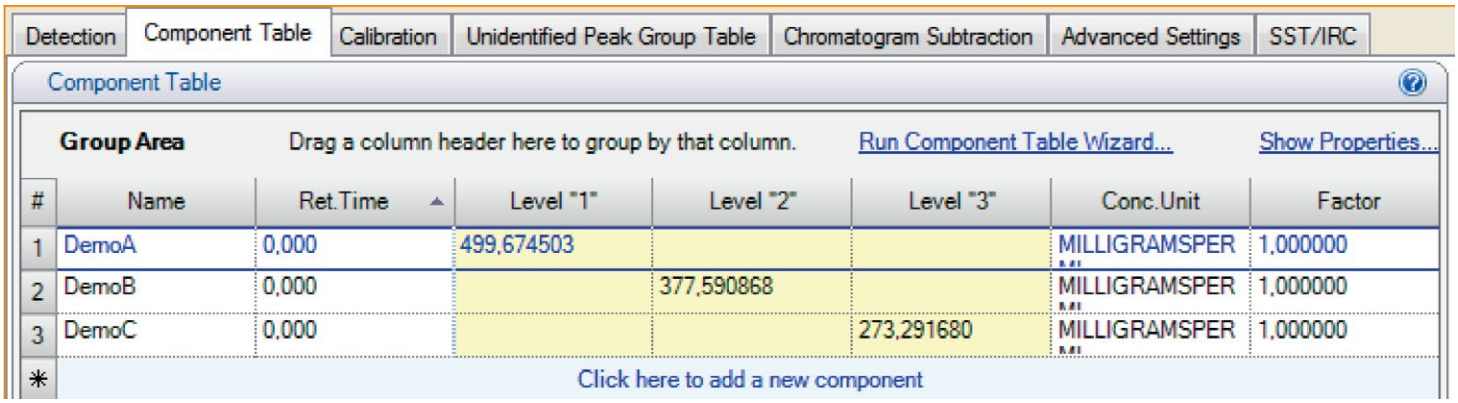
Group Area Drag a column header here to group by that column. Run Component Table Wizard... Show Properties...

#	Name	Ret.Time	Level "1"	Level "2"	Level "3"	Conc.Unit	Factor
1	DemoA	0,000	500,000000				1,000000
2	DemoB	0,000		400,000000			1,000000
3	DemoC	0,000			300,000000		1,000000
*	Click here to add a new component						

When the command "Send weighing input to scale" is activated, data, such as the name of the standard and the desired concentration, is transmitted to the Cubis® MSA dosing system. The software application installed on the balance uses this desired concentration to calculate the amounts to be weighed, shows these values to the user for verification and then starts the weighing and dispensing procedure.

This process is repeated until all standard samples transmitted by Chromeleon have been processed. The data saved for the standards is retrieved from the balance using the function "Retrieve weighing result from scale" and transmitted to Chromeleon. The verified concentrations of the standards and the unit are saved by Chromeleon and used for later evaluation. This direct communication interface ensures the highest data integrity as there is no need for any manual inputs, or such inputs are not possible in the first place, in order to exchange data.





Chromeleon* 7.2 SR4 enables fully automated data management of any number of standards. Connection of the Cubis® MSA dosing system to Chromeleon is recommended for extending analytical laboratories' capabilities for automation of workflows. Ultimately, automation signifies considerable time savings compared with manual data exchange while increasing process reliability.

* Dionex™ Chromeleon™ 7.2 Chromatography Data System (CDS) software is a trade mark of company Thermo Scientific™

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