Ensuring Safety - Every Day in the Lab

"This clearly documents that with the SCAT Safety Cap an evident reduction in the methanol concentration in the test chamber to nearly 0 was achieved, so the workplace limit value of 270 mg/m³ specified by TRGS 900 was fallen well below."

SGS Institut Fresenius was commissioned to investigate reduction of emissions achieved by use of SCAT Safety Caps.

In this respect, 1000 ml solvent bottles with and without Safety Caps were used and the emissions over a period of 28 days compared.

Then test chamber tests were conducted over a period of 7 days, during which the level of emissions in atmosphere were regularly monitored.

The solvent components tested as examples were the tested compounds methanol/water (ratio: 80/20), acetonitrile and methanol.

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No change in the mixture ratio was found with SCAT Europe Safety Caps

Determining the changes in density and volume

SGS Institut Fresenius GmbH was commissioned by SCAT Europe GmbH to evaluate the effectiveness of their SCAT Safety Caps in comparison to a solvent bottle without SCAT Safety Caps. Changes in density of a methanol/water mixture were examined to determine if use of the SCAT Safety Cap could prevent a change in the mixture over an longer time of 8 days.

A comparison of the measured results shows that in a bottle fitted with the SCAT Safety Cap no change in density occurs, the initial density of 0,855 g/cm³ stayed constant throughout the entire 8 days of the test. In contrast to this, the solvent bottle without a SCAT Safety Cap displayed a demonstrable change in density so that the initial value of 0,855 g/cm³ of the solvent mixture rose to a density of 0,858 g/cm³ (Fig.1). An increase in density indicates that there has been a greater loss of methanol than of water from the mixture. This loss did not occur in the same mixture ratio.

Therefore a change in the composition of the methanol/water mixture can be assumed, which then could result in errors in measured values under laboratory conditions. In contrast to this, in the solvent bottle with the SCAT Safety Cap, no change in the mixture ratio was found so that errors in measured values due to a change in the solvent mixture can be excluded.

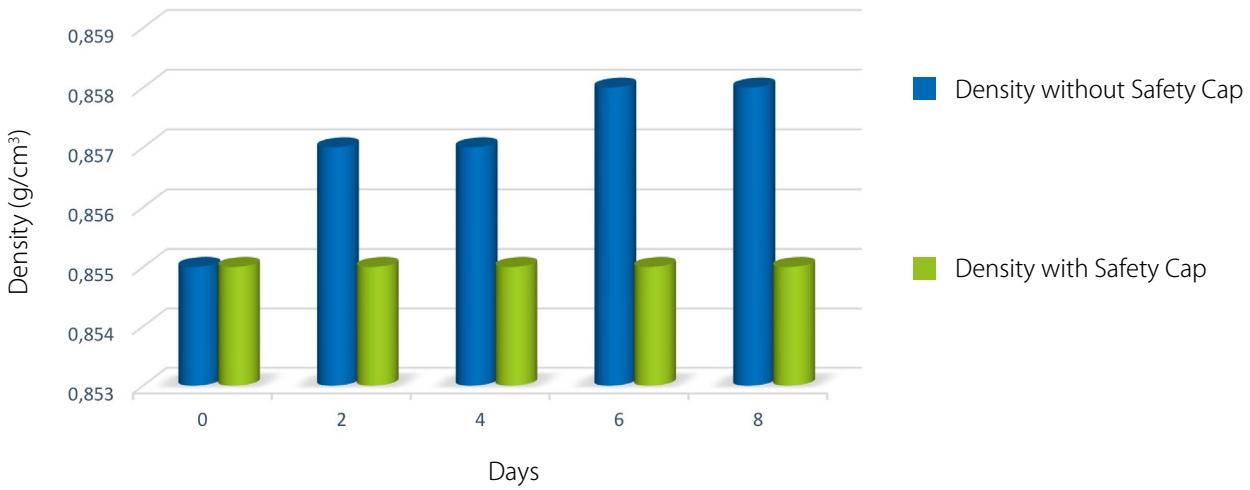

Fig. 1 Changes in the density of a methanol/water mixture

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Quality Assurance Measures
SCAT Europe Safety Caps

Characterization of the change in volume in methanol and acetonitrile

The first step in this test was to determine change in volume by means of differential weighing over the 28 day pilot study in which both acetonitrile and methanol were specified as solvents. These two solvents were used to generate the best possible comparison with real on-site conditions in a HPLC laboratory. Based on the measurement results it is evident that in both series of trials with the SCAT Safety Cap, scarcely any change in volume over the period of 28 days was observed. In comparison to this, without the SCAT Safety Cap, a significant reduction in the given volume of 1 litre was found within the period of the trial (Fig. 2).

In the acetonitrile bottle without a Safety Cap, a reduction in volume of almost 10 % occurred so that after 28 days, only 90 % of the initial volume remained in the solvent bottle. Consequently, after 4 weeks, almost 10 % of the solvent quantity was lost, having escaped unfiltered into the atmosphere.

During differential weighting to determine the change in volume of methanol, it was evident that an even more significant reduction had occurred in the solvent bottle not fitted with a SCAT Safety Cap: After 28 days, only 87.8 % of the initial volume remained in the open solvent bottle, compared with 100 % of the initial volume remaining in the solvent bottle equipped with the SCAT Safety Cap. It is obvious that almost 13 % of the solvent quantity used are lost, having escaped into the atmosphere from the solvent bottle not fitted with a SCAT Safety Cap.

Characterization of the atmospheric concentration by test chamber investigations

In order to investigate the atmospheric emissions caused by open solvent bottles in comparison to a solvent bottle with SCAT Safety Cap, one of each solvent bottles were placed in a test chamber and their respective methanol or acetonitrile emissions were tested after 1, 3 and 7 days (fig. 3).

It was evident that within the test chamber, despite continuous air exchange a methanol concentration of 630 – 660 mg/m³ could be determined for the solvent bottle without Safety Cap, whereas a concentration of 1 – 2 mg/m³ was analyzed for a solvent bottle with SCAT Safety Cap.

This clearly documents that with the SCAT Safety Cap an evident reduction in the methanol concentration in the test chamber to nearly 0 was achieved, so the workplace limit value of 270 mg/m³ specified by TRGS 900 was fallen well below.

In contrast to this, without Safety Cap the concentration of 630 – 660 mg/m³ clearly exceeds the workplace limit value to constitute a background exposure which can lead to impairment of employees' health in the laboratory.

A similar picture also results from the test chamber investigation with acetonitrile, in which a concentration of 1 – 5 mg/m³ was determined with Safety Cap, as opposed to an atmospheric concentration of 730 – 800 mg/m³ without the SCAT Safety Cap, despite continuous air exchange (Fig. 3).

Comparison of the detected test chamber emissions with the acetonitrile limit values of 34 mg/m³ specified by TRGS 900 showed that without the SCAT Safety Cap, the workplace limit value was evidently exceeded. In contrast to this, with the SCAT on the bottle a distinct minimization of the acetonitrile concentration was determined, which was well below the workplace limit value of 34 mg/m³ specified by TRGS 900 (fig. 4).

Test Report
Conclusion

Conclusion

In conclusion, it is evident that solvent emissions could be significantly reduced by the SCAT Safety Caps. In this respect, the use of SCAT Safety Caps can be expected to lead to a clear reduction of the exposure to solvents in the air in a laboratory.

In this connection the reduction in the solvent concentration in the air can be assumed to be of a similar proportion as was described previously, leading to significantly lower health risk for the employees concerned.

Furthermore, SCAT technology significantly minimizes the risk of contamination of solvent-free blank samples in laboratories, so the use of SCAT Safety Caps can also be considered a measure of quality assurance.

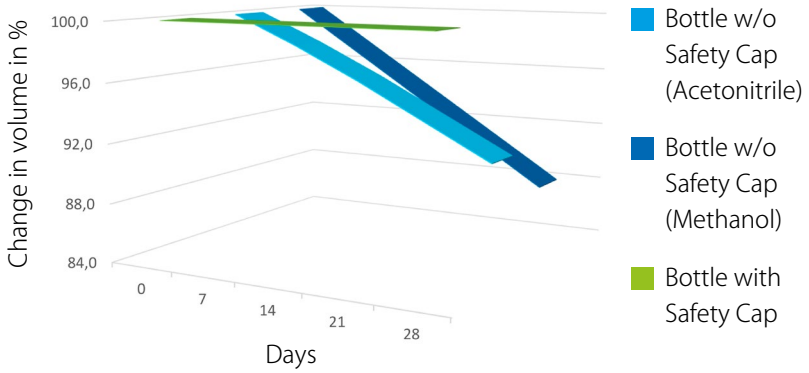

Fig. 2 Changes in volume of methanol and acetonitrile

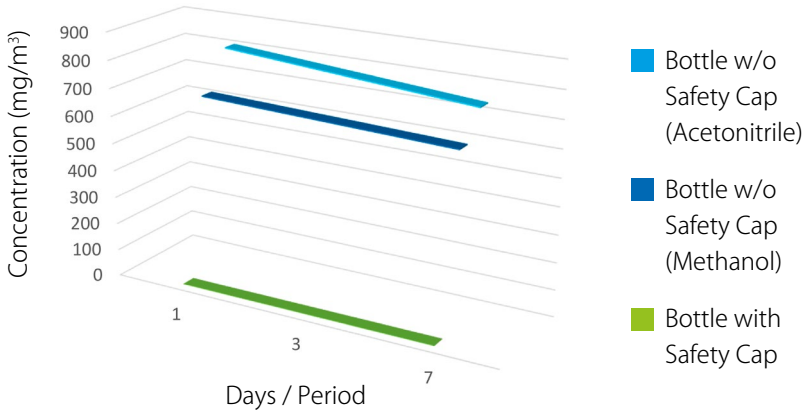

Fig. 3 Methanol emissions and acetonitrile emissions in the test chamber

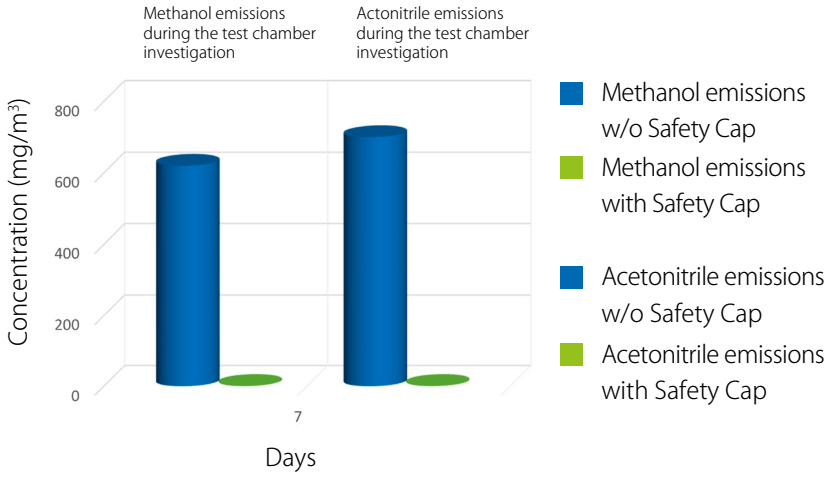

Fig. 4 Methanol emissions and acetonitrile emissions in the test chamber