Introduction
The AOAC method 964.21 describes the determination of formaldehyde in maple syrup. This official method was released in 1964 and specifies dedicated equipment, which is sorted out in today’s laboratories (e.g. condenser with asbestos insulation). This work describes the formaldehyde determination following the relevant instructions of AOAC method 964.21 but using modern instrumentation (classical Kjeldahl instrumentation, spectrophotometer), which are simple to use, cost effective and available in today’s laboratories.

Official regulations
- Determination of formaldehyde in emulsion paints
(German Association of Lacquer Industry) [3]
- Determination of formaldehyde in maple syrup
(Official AOAC Method 964.21) [4]
- Determination of formaldehyde in textiles
(European Norm ISO 14184-1) [5]
- Determination of formaldehyde in household products
(Official test method in Japan Law 112).
- Determination of formaldehyde in water

Methodology
This method describes a procedure for the quantitative determination of formaldehyde in a diluted formalin solution in concentration range of > 0.220 mg/L. The determination of formaldehyde is done by steam distillation, followed by spectrophotometry. Formaldehyde reacts with acetylacetone in the presence of ammonium acetate to form 3,5-diacetyl-1,4-dihydrolutidine. (Hantsch-Reaction [1]) The absorption of this compound is measured at 412 nm using cells with an optical path length of 10 mm.

Spectrophotometrical measurement
- Transfer 2.5 g of the distillate to a 25 mL volumetric flask
- Add 50 mL deionized water and 20 mL H2SO4 (25%) by pumping the acid with the acid resistant pump
- Add 30 mL deionized water to the receiving vessel
- After 2 hours record the adsorption of the formaldehyde/acetlacetone reagent complex at 412 nm using cells with an optical path length of 10 mm

Verification
For verification, the determination of formaldehyde has been confirmed by the analysis of a 0.25 mg/L formaldehyde solution. Using the calibration curve the formaldehyde concentration can be calculated after measuring the extinction of the samples and thus the recoveries.

Spectrophotometric Determination and Calibration Procedure
Determination of the formaldehyde content of a standard solution Pipette 20.0 mL of the standard solution (3 g of formaldehyde solution (93.6% in H2O) diluted with deionized water to 1000 mL) into a beaker, add 25.0 mL of a 0.05 mol standard iodine solution and 10.0 mL of 1 mol sodium hydroxide solution. After 5 min acidify with 11.0 mL of 1 mol hydrochloric acid and determine the excess iodine by titration with a 0.1 mol standard sodium thiosulphate solution.

From each of the 10 mL volumetric flasks from the dilution series transfer 2.5 g of the solution to a 25 mL volumetric flask. Dilute this solution with 10 mL of the acetylacetone reagent and fill up to the 25 mL with deionized water. After 2 hours record the adsorption of the formaldehyde/acetlacetone reagent complex at 412 nm using cells with an optical path length of 10 mm.

Conclusion
The threefold determination of the formaldehyde-content of a 0.25 mg/L formaldehyde solution gives a recovery of 98.8% with a small RSD of 0.3%.

The use of steam distillation as a separation process is a proven and cost-effective method utilised in many areas of food production, animal feed manufacture, cosmetic industry and environmental analysis. The presented Buchi method for the determination of formaldehyde is based on a modification of the classical Hantsch-Reaction. The method is fast and shows comparable method performance.

References
[2] DIN 32645
[4] AOAC Official Methode 964.21
[5] EN ISO 14184-1