Experimental study of buoyancy and surface tension effects of an immersed capillary gravimetric micro-flow facility

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LNE-CETIAT reference micro-flow rate facility uses the start/stop gravimetric method to determine the reference flow rate. The flow range of this facility is between 1 ml/h and 10000 ml/h. The method requires the weighing of a liquid mass over of measured interval of time in order to calculate the reference flow rate. To insure the continuity of the flow (i.e. to avoid dripping effect) for flow rates down to 1 ml/h, a capillary, from which the liquid flows out, is constantly immersed in the water in the container on the scale during the measurement time. The main drawback of this method lies on the consideration of two additional biasing effects on the weighed mass, which has to be included in the uncertainty budget. The first one is the buoyancy effect due to the additional volume of the capillary immersed in the weighed mass of water in the container. The second one is the possible variation of the surface tension effect during the rise of the water along the capillary. This article presents the experimental set up developed and used to quantify those uncertainty sources, as well as the results obtained. Finally, the impact on the reference flow rate uncertainty budget is discussed.