Rotating droplet as a new alternative for small volume electrochemical measurements

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Rotating droplet as a new alternative for small volume electrochemical measurements

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Abstract

We present a simplified and flexible implementation of the rotating droplet (RD) method as an alternative to rotating disk electrodes for electrochemical measurements in a small volume system. The rotating droplet system is based on the principle of a rotating disc electrode, but the method uses only a single droplet of the investigated solution to perform the analysis. In our setup, the disk and the ring electrodes of a traditional rotating ring disk electrode are used as reference and counter electrodes, respectively. This makes it possible to use any flat, conducting surface as a working electrode. We also show that the RD method can be useful for fast detection of analytical samples present in the gaseous atmosphere around the droplet.

***Keywords**:* Rotating droplet, rotating disc electrode, hydrodynamic systems, oxygen reduction, bilirubin oxidase.

1. Introduction

Kinetic methods can be used to monitor the progress of a chemical reaction, and are crucial for describing reaction mechanisms and determining the factors which influence them. In the case of rapid reactions very fast detection methods are needed and, to overcome the problem of slow mass transport, hydrodynamic methods may be used either in a configuration where the liquid is flowing with respect to a static working electrode, or where an electrode induces liquid movement through its own motion [1–3]. Both approaches lead to the same result: mass transport is controlled by the experimental settings, thus eliminating the limitations of the signal caused by slow diffusion. Monitoring reactions with electroactive species has historically been done using a rotating disk electrode (RDE) [4,5], for which the liquid movement principles are well described analytically. Notwithstanding this, usage of