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Development of an aptamer-based biosensor for the detection of food toxins

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According to the last EFSA/ECDC report, bacterial toxins are the second leading causative agent (17.0%) of foodborne outbreaks in Europe [1]. Aptasensors, as biosensors that use aptamers are called,are seen as a simple, rapid and cost-effective assay format with high suitability for point-of-care testing,allowing a sensitive and mostly qualitative detection of analytes [2].

In this work, DNA aptamers previously selected by our group (Apt1, Apt2, Apt3, Apt4 and Apt5) for staphylococcal enterotoxin A (SEA), one of the most reported bacterial toxins, were applied asrecognition molecules in a lateral flow assay. For this, lateral flow strips consisting of a sample pad withglass fibre, test zone with nitrocellulose membrane and absorbent pad with cellulose membrane were assembled. Gold nanoparticles (AuNPs) covalently attached with Apt5 were synthesized. Biotinylated aptamers (140 pmol of Apt1, Apt2, Apt3 and Apt4) were immobilized in the test zone using streptavidinas an anchor. A DNA probe (140 pmol) complementary to Apt5 was also immobilized as a test control.Then, SEA solutions (0.3 ng/µL) as well as negative samples were prepared and incubated with Apt5- AuNPs (OD3) in binding buffer for 10 min. Different assay combinations (Apt5-AuNPs +Apt1/Apt2/Apt3/Apt4) were tested. The samples (60 µL) were applied to the sample pad, allowing the solution to flow on the strip until the test lines were visualized by the accumulation of AuNPs.

SEA samples were positively detected, with the combination of Apt5-AuNPs with Apt3, providing the best result, followed by Apt4, Apt2 and Apt1. Negative controls were validated by the control line. Further tests to determine the detection limit and improve the noise ratio are being carried out.

These results show that aptasensors can be a simple and rapid alternative for the detection of SEA. Furthermore, this format assay can be easily adapted to any food toxin.

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