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The Development of a novel o,p'-DDT-specific probe for food safety monitoring and risk assessment

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INTRODUCTION & AIM

The compound 1,1,1-trichloro-2-(p-chlorophenyl)-2-(o-chlorophenyl) ethane (o,p'-DDT) has historically been used as a pesticide, but is now recognized as an endocrine-disrupting chemical with the potential to accumulate in the food chain and cause adverse effects on wildlife and humans. Aptamer are short, single-stranded nucleic acid (DNA or RNA) molecules that have the ability to bind to a specific target molecule with high affinity and specificity. Development of a novel probe for detection of o,p'-DDT residues in food products was important.

METHOD

We obtained candidate aptamers binding to o,p'-DDT by a systematic evolution of ligands by exponential enrichment (SELEX) protocol. Library molecules that bind to the target (o,p'-DDT) were retrieved and amplified by PCR in one round of SELEX(Figure 1A). Illustration of the library immobilization process for the modified Capture-SELEX. Biotinylated complementary DNA (cDNA) probes with library ssDNA molecules were first captured on streptavidin coated magnetic beads. Library ssDNA molecules dehybridized by positive target induction were retrieved and subsequently amplified (Figure 1B).

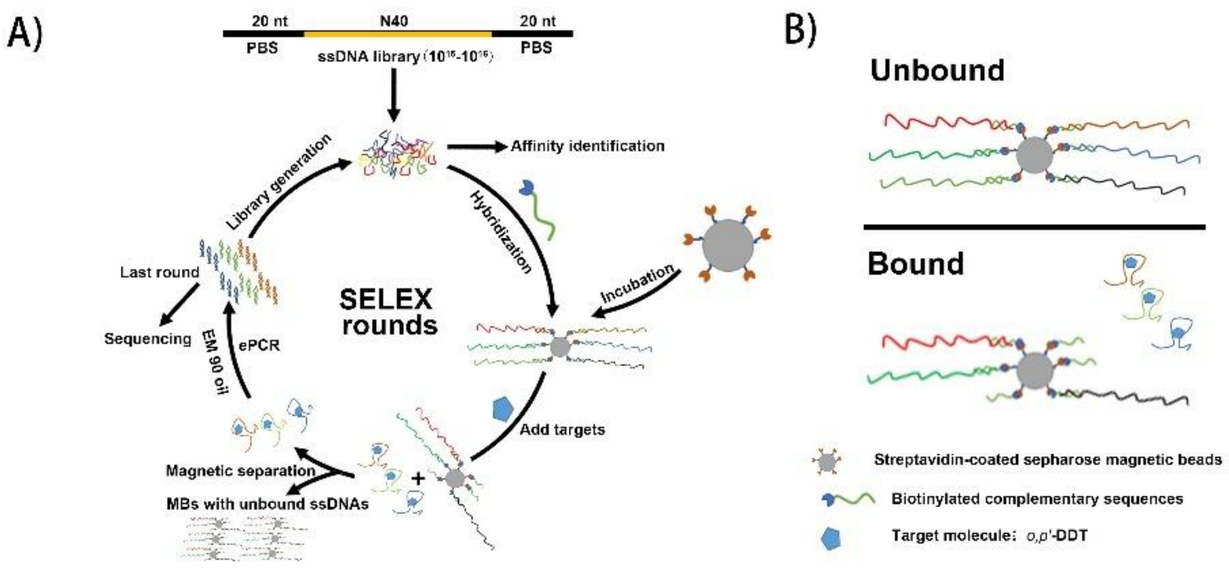

Figure 1. Illustration of the systematic evolution of ligand by exponential enrichment process.

RESULTS & DISCUSSION

DDT_13

5'-TCCAGCACTCCACGCATAACGAATTGTGCTCAATGCGCCCCTGCAGTGAATGTGGAATTTGTTATGCGTGCGACGGTGAA-3'

Predicted secondary structure of DDT_13

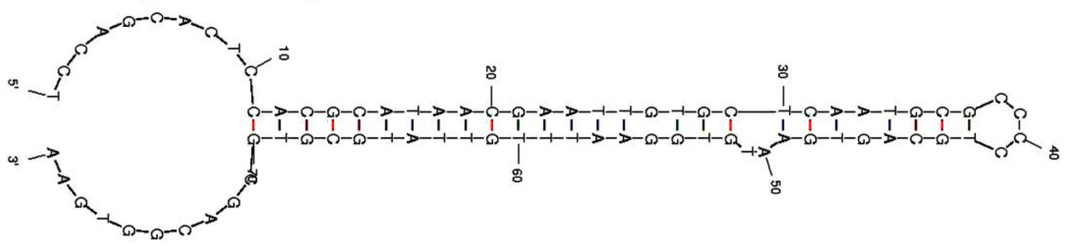

Figure 2. Full sequence of the o,p'-DDT candidate aptamer, DDT_13. The red letters are primer binding sites. Secondary structure of DDT_13 was predicted by Mfold software.

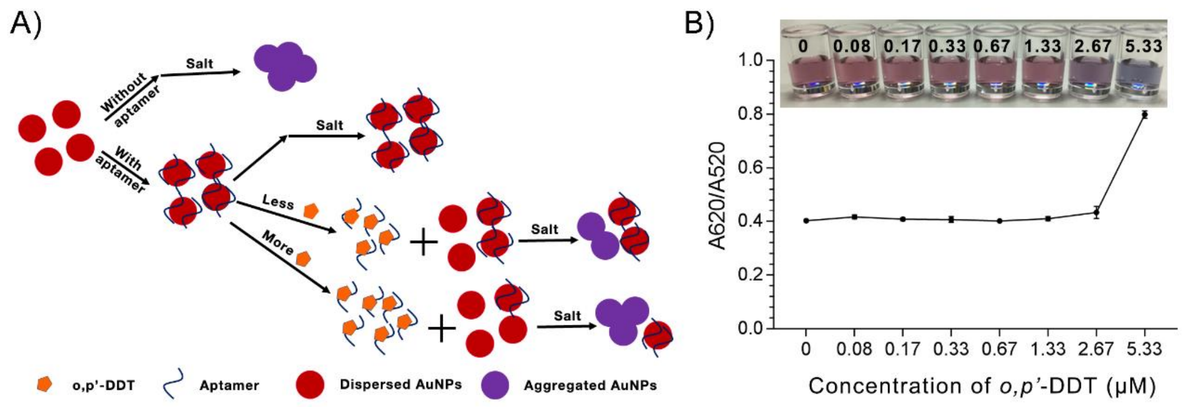

Figure 3. Gold Nanoparticles (AuNPs) colorimetric assay. (A) Schematic principle of the assay. (B) Aggregation response to o,p'-DDT addition quantified by absorbance ratio. Insert image: Digital image of the samples represented in (B).

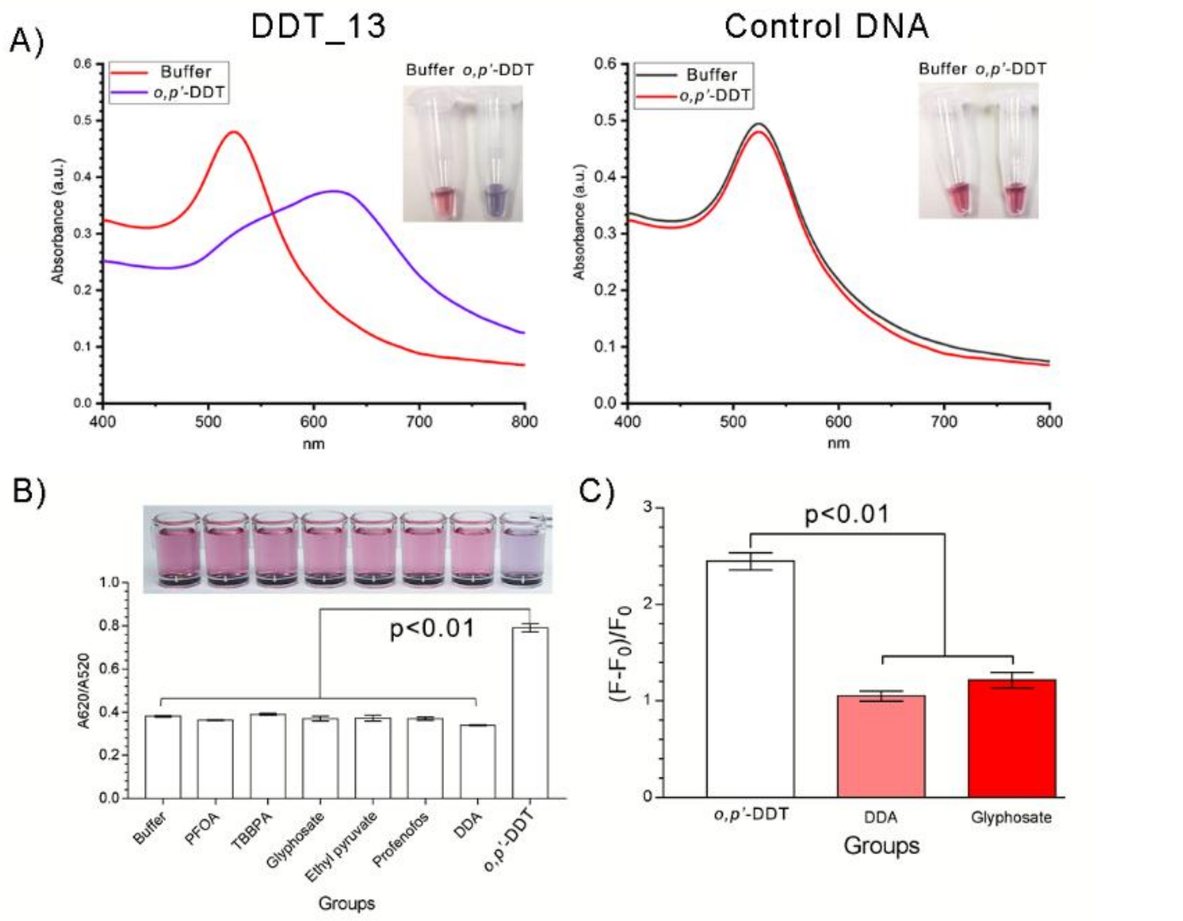

Figure 4. Analysis of selectivity of DDT_13. (A) The signal changing induced by control DNA or the DDT_13; (B) Signal changing of DDT_13 specifically responded to o,p'-DDT but not to other kinds of small molecules; (C) Fluorescence response to o,p'-DDT and other small molecules.

CONCLUSION

The aptamer's efficacy in analyzing food samples underscores its promising bioactivity, positioning it as a novel tool for o,p'-DDT detection in the context of food safety monitoring and risk evaluation initiatives.

ACKNOWLEDGMENT

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