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Study for the Development of a Biosensor Oriented at the Interaction-Response of Chemical War Agents and Ionizing Radiations

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Introduction

The development of technologies has always been gaining prominence due to its great potential in meeting demands closely linked to exposed weaknesses. These needs may be related to applications in energy, medicine, radiopharmaceuticals and curative, interventional and diagnostic health, applications in the areas of security and defense, food technologies, academic development, among others. The use of applied nuclear physics opens up a set of great possibilities due to the capacity for interaction between the development of new instrumentation and what our imagination allows us to do. The combination of applied nuclear physics and integrated biological systems allows us to convert one form of energy into a different one, based on the reading of a transduced biological signal, for example, an initial purely chemical signal into an electrical signal.

Keywords: Biotechnology; Biosensor; Organophosphate; Nuclear; Radiation

Methodology

With regard to theoretical studies and modeling, the following tools are used:

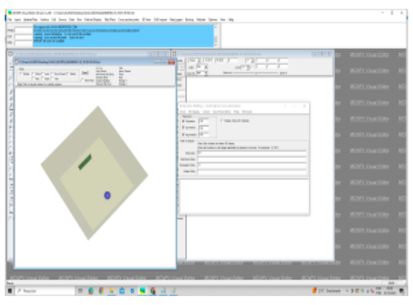

Fig. 01: VISED 3D System

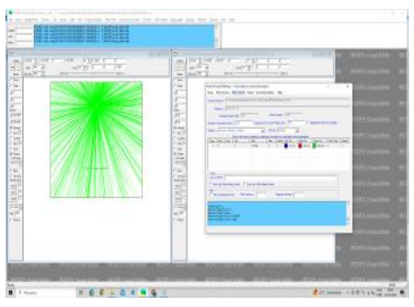

Fig. 02: VISED System Simulation

Fig. 03: AChE Enzyme - PDB

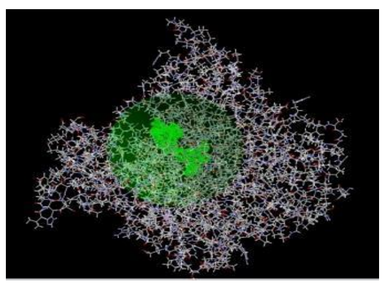

Fig. 04: Region of interest in the AChE Enzyme

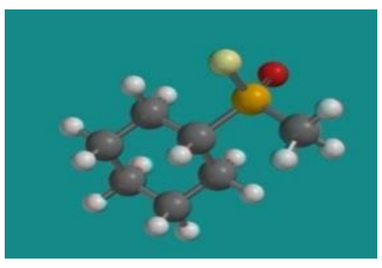

Fig. 05: Cyclosarin

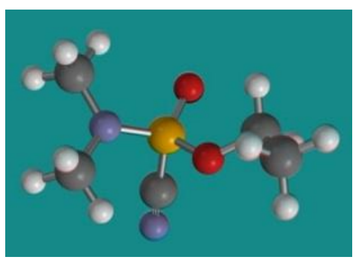

Fig. 06: Tabun

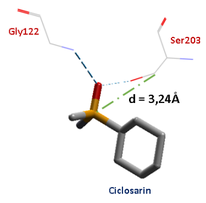

Fig. 07: Docking with cyclosarin

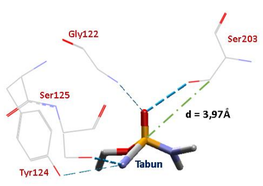

Fig. 08: Docking with Tabun

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Results and Discussion

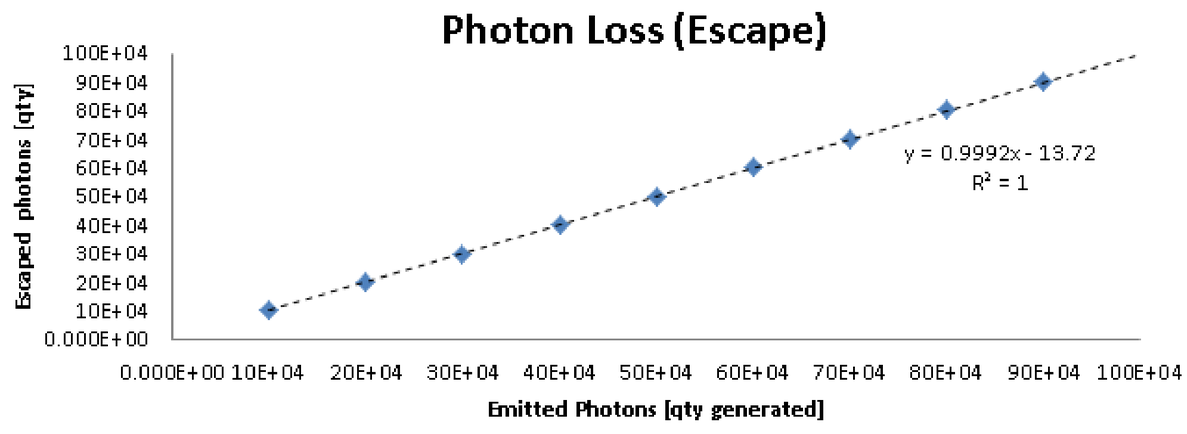
Chemistry Simulation:

Table 01: Docking results expressed in energy fluctuations, distances from the molecular target and interaction residues.

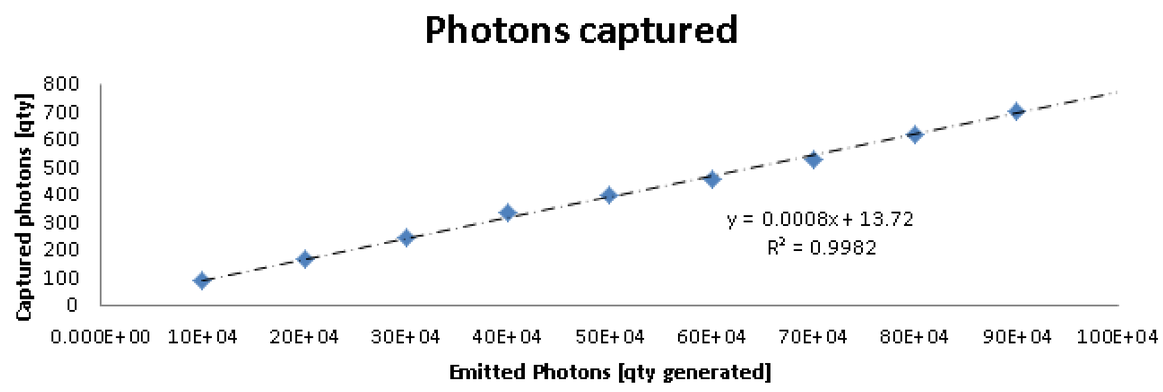
Molecule	Score [kCal/mol]	Distance [Å]	Residue
Ciclosarin	-64,23	3,24	Ser - 203 / Gly - 122
Sarin	-57,82	3,55	Ser - 203 / Gly - 122
Soman	-61,03	3,31	Ser - 203 / Gly - 122
Tabun	-58,84	3,97	Ser - 203 / Gly - 122 / Ser - 125 / Tyr - 124
VR	-100,21	3,10	Ser - 203 / Gly - 122
VX	-94,73	3,41	Ser - 203 / Gly - 122
Novichok - A230	-81,18	3,15	Ser - 203 / Gly - 122
Novichok - A232	-78,44	3,12	Ser - 203 / Gly - 122
Novichok - A234	-85,50	3,31	Gly - 122
Novichok - A242	-99,24	3,28	Tyr - 124 / Gly - 122
Novichok - A262	-109,24	3,22	Ser - 203 / Gly - 122
Aflatoxina B1	-138,79	XX	Tyr - 124 / Tyr - 337
Aflatoxina M1	-139,06	XX	Tyr - 124 / Ser - 125 / Tyr - 337

RN Simulation:

Graph 01: Photons Loss



Graph 02: Photons Captured



Conclusion

The research and data guide the formalization and materialization of the prototype, since a subtle variation in the electrical potential can be measured, conclusions and inferences can be made. This can generate significant impacts, both due to its innovative potential and as a resource to be used in the field compared to systems that use radionuclides for other studies.

Acknowledgements

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