Supporting Information for:

Effect of ambient polycyclic aromatic hydrocarbons and nicotine on the structure of $A\beta_{42}$ protein

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Table S1: Density of B[a]P, nicotine and phenanthrene molecules, computed at reference temperature and compared with the literature values.

	Simulations	Literature
B[a]P at 20ºC	1.218 ± 0.002 g/cm^3	1.4 g/cm^3 [1]
Nicotine at 20ºC	1.061 ± 0.003 g/cm^3	1.00925 g/cm^3 [2]
Phenanthrene at 25ºC	1.126 ± 0.003 g/cm^3	1.179 g/cm^3 [3]

[1] pubchem.ncbi.nlm.nih.gov/compound/BENZO_a_PYRENE#section=Density
[2] pubchem.ncbi.nlm.nih.gov/compound/89594#section=Density
[3] pubchem.ncbi.nlm.nih.gov/compound/995#section=Density

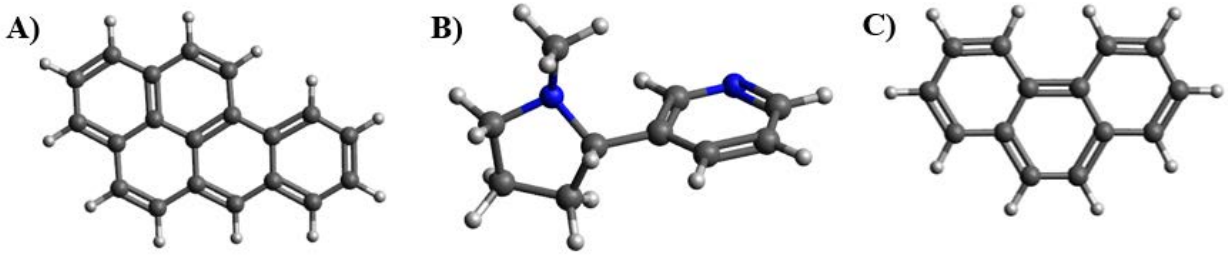

Figure S1: Structures of A) benzo[a]pyrene, B) nicotine and C) phenanthrene molecules with carbon in grey, hydrogen in white and nitrogen in blue.

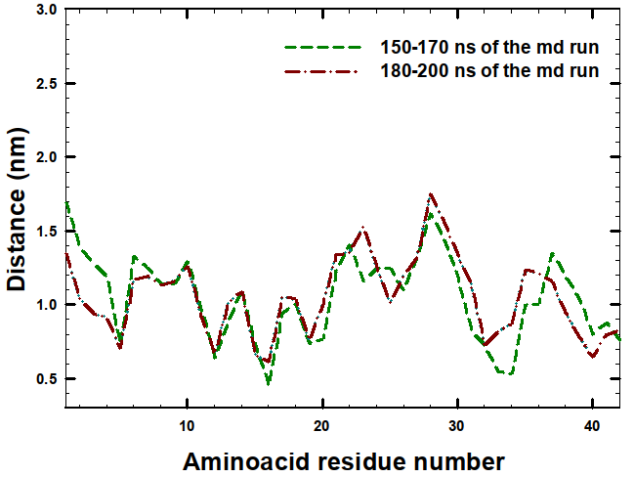

Figure S2. Distances between center of masses of the amino acid residues of $A\beta_{42}$ monomer and phenanthrene molecule averaged within two different periods of time: 150 – 170 ns of the simulation and 180 – 200 ns of the simulation.

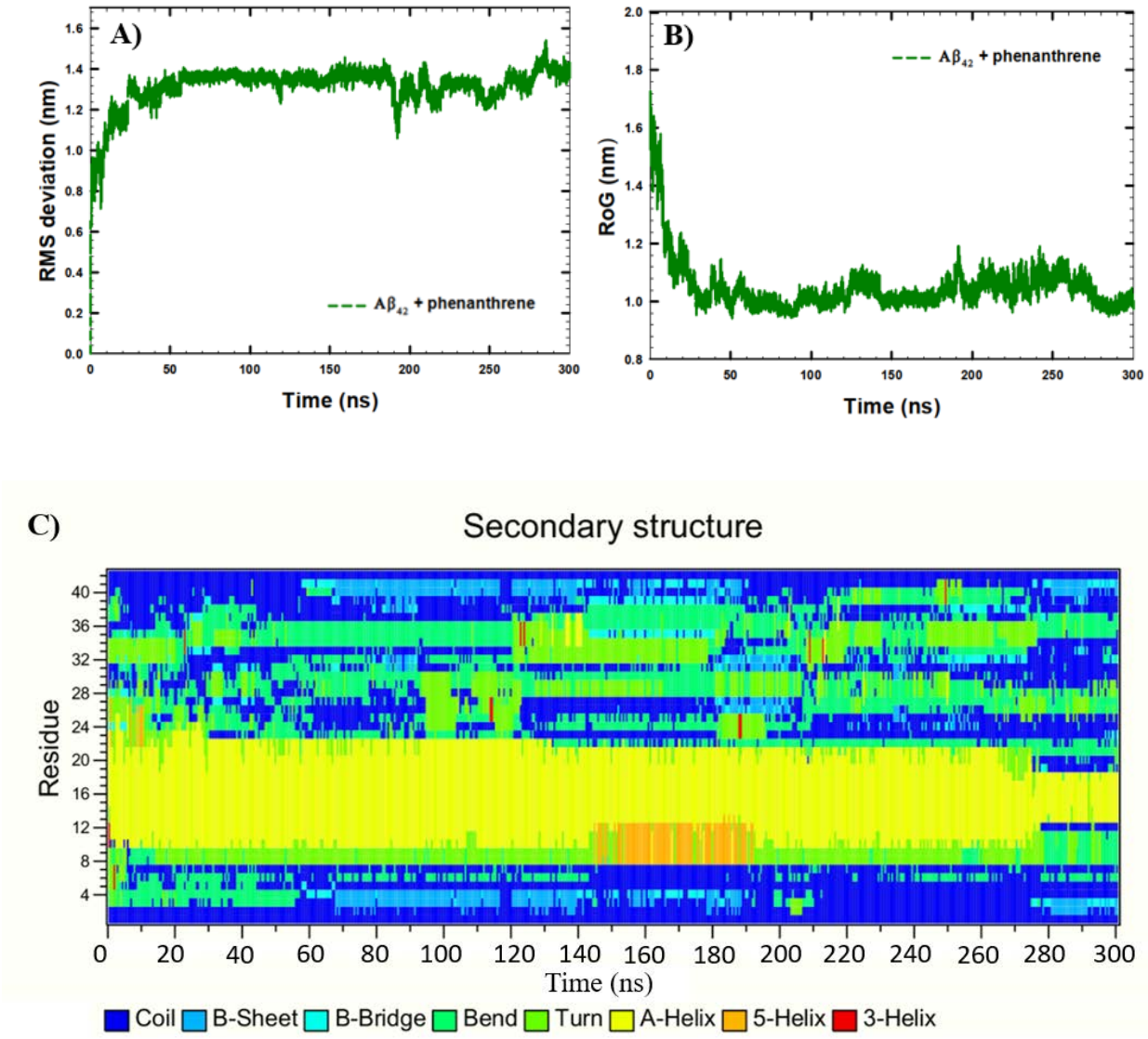

Figure S3. Time-evolution of A) RMS deviations of Aβ42 peptide, B) Radius of Gyration of Aβ42 peptide, C) Secondary structure of Aβ42 peptide in the presence of phenanthrene molecule during 300 ns of the simulation.

Table S2. Energy analysis for the last 10 ns of the molecular dynamics simulations.*

	Peptide – Peptide (kJ/mol)				**Peptide – environmental pollutant (kJ/mol)**			
System	Coul - SR	LJ - SR	Coul - 14	LJ - 14	Coul - SR	LJ - SR	Coul - 14	LJ - 14
$A\beta_{42}$	-10912 ±29	-821.8 ±5.5	6994.4±5.5	1.4 ±1.3	-	-	-	-
$A\beta_{42}$ + nicotine	-10952 ±21	-797.6 ±4.6	7024.1 ±7.5	-4.6 ±1.4	-7.7 ±1.1	-64.2 ±1.6	0	0
$A\beta_{42}$ + B[a]P	-10953 ±19	-762.4 ±3.7	6981.2 ±1.8	0.17 ±1.6	-16.48 ±0.36	-86.89 ±0.46	0	0
$A\beta_{42}$ + phenanthrene	-10961 ±19	-764.7 ±7.3	7022.3 ±3.8	-5.9 ±1.8	-10.8 ±1.9	-82 ±8	0	0

*According to the energy analysis performed for the system with no environmental pollutants, among short-range ("SR") intrapeptide interactions of $A\beta_{42}$ monomer, coulombic interactions ("Coul-SR" = –10912 ± 29 kJ/mol) were predominant over "Lennard – Jones" interactions ("LJ-SR" = –821.8 ± 5.5 kJ/mol). With the addition of the environmental pollutants, short-range coulombic intrapeptide interactions were slightly increased, while the van der Waals intrapeptide interactions were decreased in all systems under the study, indicating that the electrostatic interactions within a peptide were increased in the presence of B[a]P, nicotine and phenanthrene molecules. Among three environmental pollutants, the smallest change in the intrapeptide "LJ-SR" value was observed in the presence of nicotine ("LJ-SR" = –797.6 ± 4.6 kJ/mol), in comparison to the system with B[a]P ("LJ-SR" = –762.4 ± 3.7 kJ/mol) and phenanthrene ("LJ-SR" = –764.7 ± 7.3 kJ/mol). In addition, according to the energy analysis of the interactions between peptide and environmental pollutants, short-range "Lennard-Jones" interactions were predominant. Among the environmental pollutants under the study, short-range van der Waals interactions with $A\beta_{42}$ monomer were slightly lower for the system with nicotine ("LJ-SR" = –64.2 ± 1.6 kJ/mol), in comparison to the systems with B[a]P ("LJ-SR" = –86.89 ± 0.46 kJ/mol) and phenanthrene ("LJ-SR" = –82 ± 8 kJ/mol). This observation showed that binding energy was decreased with the presence of intermolecular H-bonds, consistent with the literature [4].

[4] Jokar, S., et al. Bioorg Chem, 2020.