Supporting Information for

Investigating the correlation between the protein adhesion simulation and the biocompatibility of polymeric substrate for skin tissue engineering applications

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Geometry optimization of the systems

Table S1*. The geometry optimization task carried out throughout the simulations.*

Algorithm	Smart
Energy ($kcal/mol$)	10^{-3}
Force ($kcal/mol/Å$)	0.5

Table S1 shows the criterias selected for the Geometry optimizaion task in Materials Studio's Forcite module. This task helps to change and optimize the geometry of the structre according to the chosen criterias, energy and force in this case. This process continues until either the final iteretion or the criterias are reached. Hence, a successful task result in a substrate with the minimum potential energy.

Polymer surface and bulk substrate annealing

Table S2. *The anneal task carried out on the unit polymerics surface.*

Annealing cycles	2
Initial temperatures (K)	298
Mid-cycle temperature (K)	450
Ensemble	NVT
Thermostat	Berendsen
Time step (fs)	1
Total simulation time (ns)	2

Table S3. *The anneal task carried out on the bulk polymerics surface.*

Annealing cycles	2
Initial temperatures (K)	298
Mid-cycle temperature (K)	450
Ensemble	NVT
Thermostat	Berendsen

Time step (fs)	1
Total simulation time (ns)	3.5

Table S2 and S3 shows the criteria for unit and bulk polymeric cell, respectively. Since using the Geometry optimization task might cause the structure to be trapped in a local energy minimum and finishing the simulation prematurely, utilizing the Anneal task will search for the minimum energy of the structure in a much wider range by increasing and then decreasing the temperature of the substrate controlled via a selected thermostat.

Dynamics simulation parameters carried out on the protein-polymer system

Table S4*. The final molecular dynamics run carried out on the protein-polymer surface.*

Ensemble	NVT
Thermostat	Berendsen
Temperature (K)	310
Time step (fs)	1
Total simulation time (ns)	2.5

After placing the protein near the relaxed polymeric surface, a Dynamics task will be carried out **Table S4**. In this task the structures will move according to the computed forces and factors like temperature controlled via a thermostat and the selected ensemble.

Lattice parameters of Polymer surface and bulk substrate

Table S5*. the lattice parameters of constructed unit and bulk polymer surfaces.*

Samples	**Unit models**	**Bulk models**
Lattice dimensions	$43.092\text{Å} \times 43.092\text{Å} \times 20\text{Å}$	$129.275\text{Å} \times 129.275\text{Å} \times 20\text{Å}$

The lattice parameters of unit cells with periodic boundary condition constructed by assembling the polymer oligomers together. Furthermore, the bulk models were created by assembling the fabricated the unit cells next to each other in the $x-y$ plane.

Berendsen thermostat

The Berendsen method utilizes an external bath with constant temperature or pressure with adjustable time constants. Here, the gradual heat transfer between the selected structure and the environment which is governed by the temperature scaling factor (λ) (**Eq. S1**).

$$\lambda = \sqrt{1 - \frac{\Delta t}{\tau}\left(\frac{T_{instant} - T_0}{T_{instant}}\right)} \quad \text{(Eq. S1)}$$

Where Δt, τ, $T_{instant}$, and T_0 corresponds to time step, relaxation time, instantaneous temperature, and target temperature. This method allows for an accurate constant-temperature ensemble and can be expanded to polyatomic molecules [1].

Total energy of the simulated protein-polymer systems

Table S6*. The total energy of the simulated protein-polymer systems*

	$E_{non\text{-}bonded}\left(\frac{Kcal}{mol}\right)$		$E_{H\text{-}bond}\left(\frac{Kcal}{mol}\right)$		$E_{van\ der\ Waals}\left(\frac{Kcal}{mol}\right)$	
	Collagen	Fibronectin	Collagen	Fibronectin	Collagen	Fibronectin
CH/G-1:3	387.193	180.900	-11.118	-7.372	376.075	173.528
CH/G-1:2	365.438	182.775	-3.500	-17.244	361.938	165.531
CH/G-1:1	347.983	151.122	-21.230	-17.345	326.753	133.777
CH/G-3:1	428.634	226.194	-10.372	-34.229	418.262	191.965
CH/G-2:1	410.120	237.332	-10.281	-18.342	399.839	218.99

References

1. Berendsen, H.J., et al., *Molecular dynamics with coupling to an external bath.* The Journal of chemical physics, 1984. **81**(8): p. 3684-3690.