Supplementary material

Synthetic Biology with Nanomaterials

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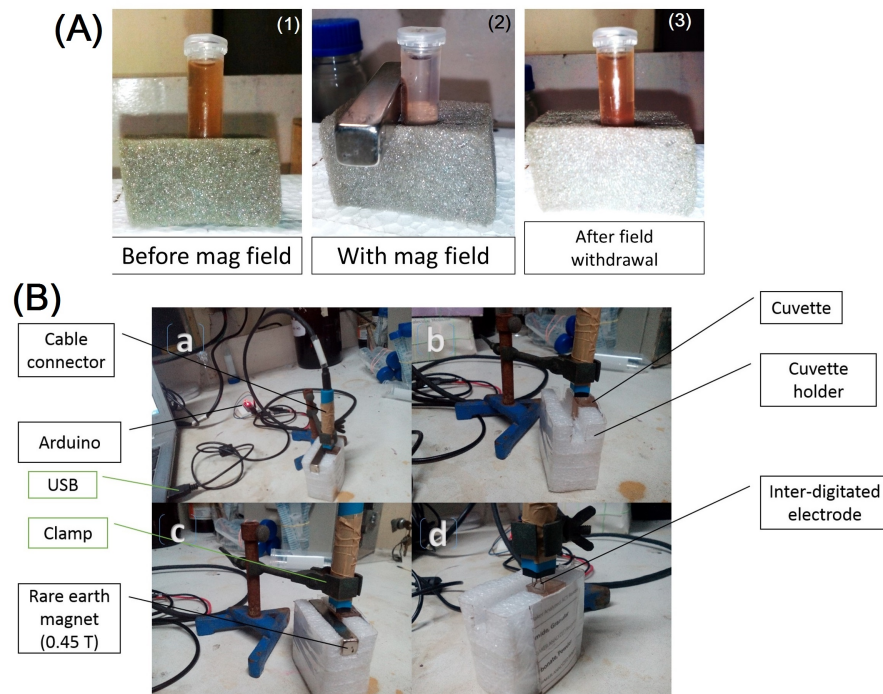*Corresponding author: **Anjan Dasgupta**; email: **adgcal@gmail.com; adbioc@caluniv.ac.in**; +91 9748758663

Figure S1: Set-up for electrical monitoring of artificial aggregation. (A) Aggregation of SPION-coated bacteria in magnetic field. (B) Photograph showing various components of the set-up (a) connections between components, magnet, cuvette, electrode, cable connector, Arduino and laptop. (b-c) placement of electrode near cuvette wall and magnet. Note the groove which holds the magnet. (d) Close up view of how electrode is placed.
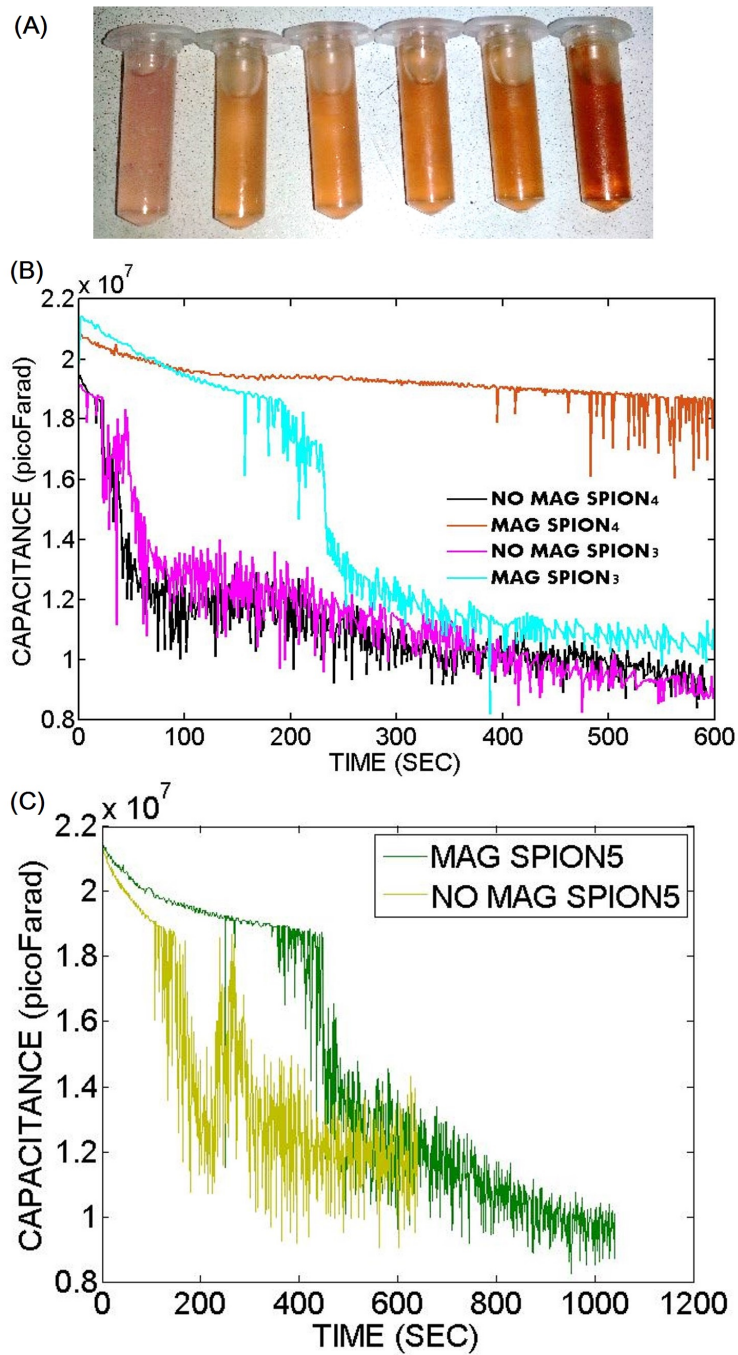
Figure S2. (A) Bacterial suspension, bacteria + SPION , 5:5, 6:4, 7:3 and 8:2 and only SPION respectively. (B) Real time capacitance for 6:4 and 7:3 respectively. (C) Real time capacitance for 5:5.
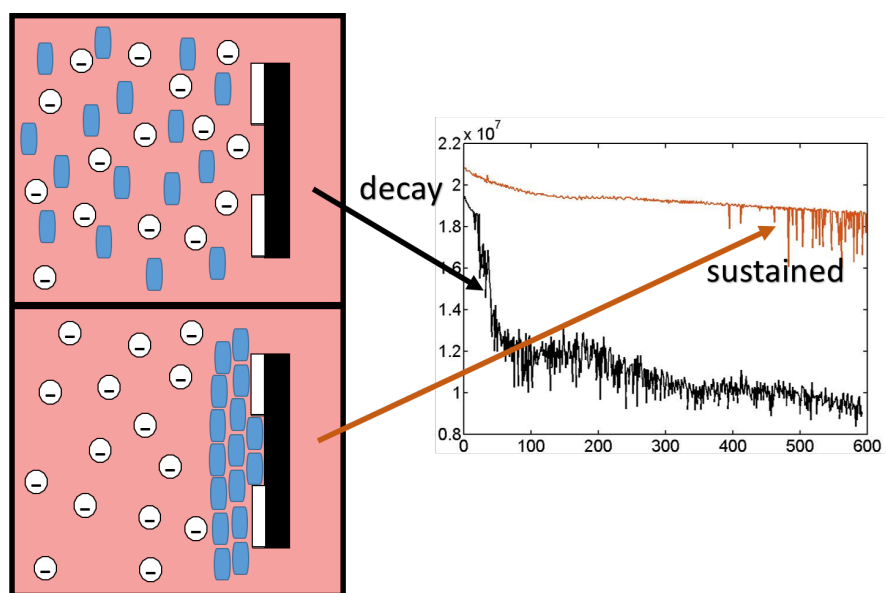
Figure S3. ***How local dielectric constant changes upon aggregation*** Bacterial suspension consists of cells (dielectric) + ions (charge). Capacitance decay is due to charge leakage by ions (medium). Sustained capacitance occurs when ions cannot access IDE surface
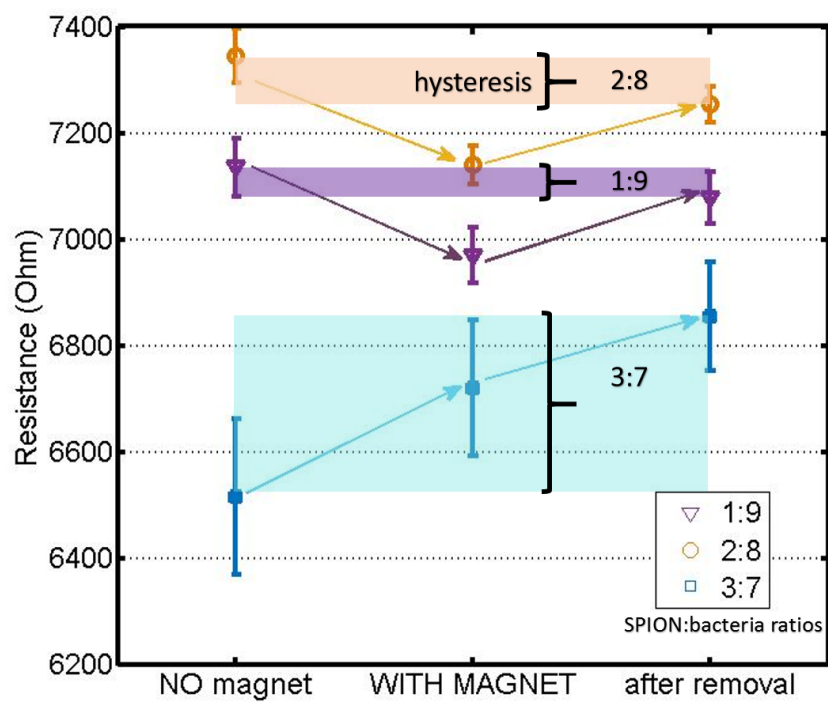
Figure S4. Dependence of resistance change and hysteresis on SPION-bacteria ratio
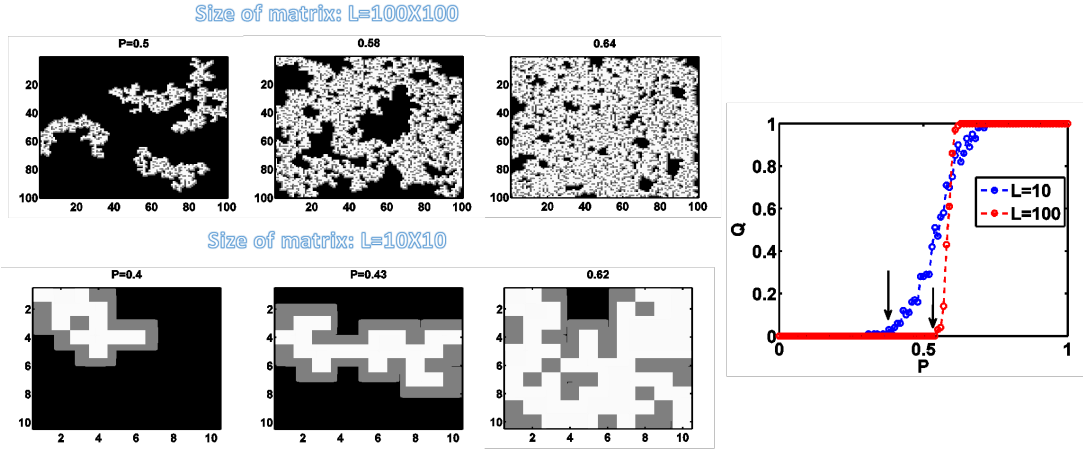
Figure S5:Percolation: Effect of confinement-Percolation is the build up of a connection or transition between two sides or states. Crowding can lead to such connection. Artificial crowding can be achieved when percolation volume is reduced. See program *twodperc.m* Hosted on $https : //drive.google.com/open?id = 16brYLc5THn8RlYcOMhwricyyJZR3fkJC$
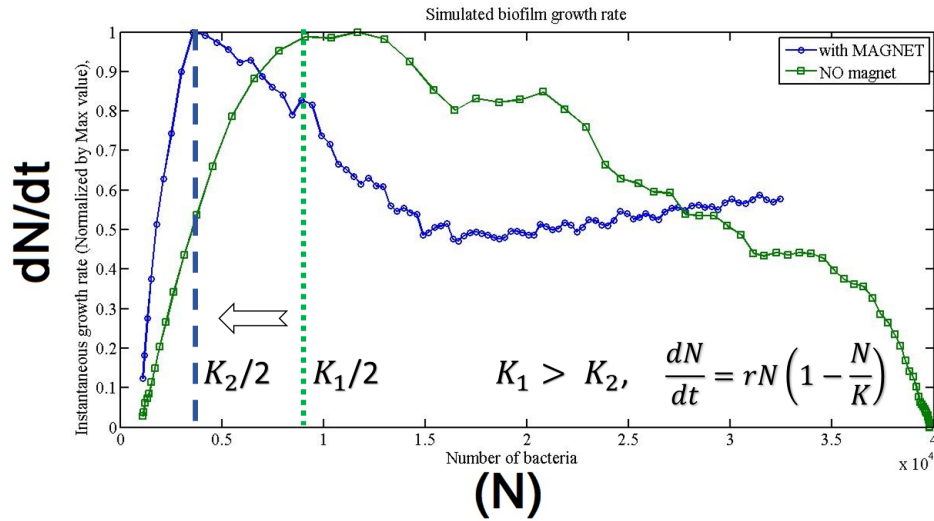

Figure S6: Biofilm growth simulation-Apparent carrying capacity (K_{app}) is *decreased*,Since space for growth is constant $\rightarrow$, crowding and growth rate peak has shifted to lesser population. See program *biofilm_mag.m* Hosted on $https : //drive.google.com/open?id = 16brYLc5THn8RlYcOMhwricyyJZR3fkJC$

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