

## Supplementary materials

# Mechanistic insight into graphene coatings for oral biofilm inhibition and osteoblast compatibility

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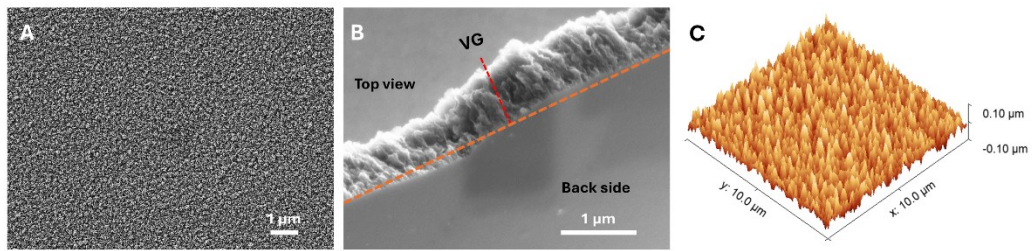
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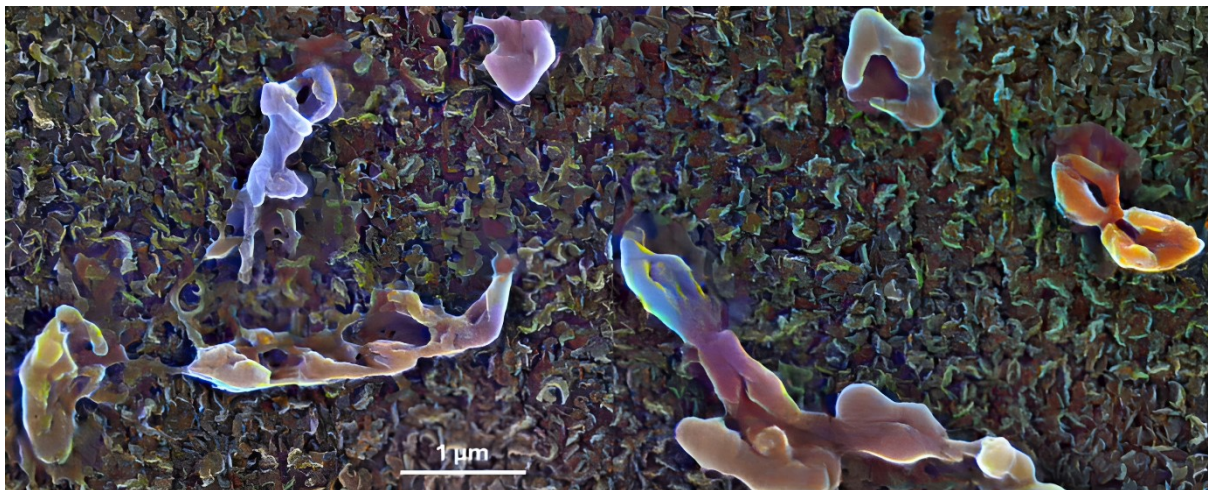
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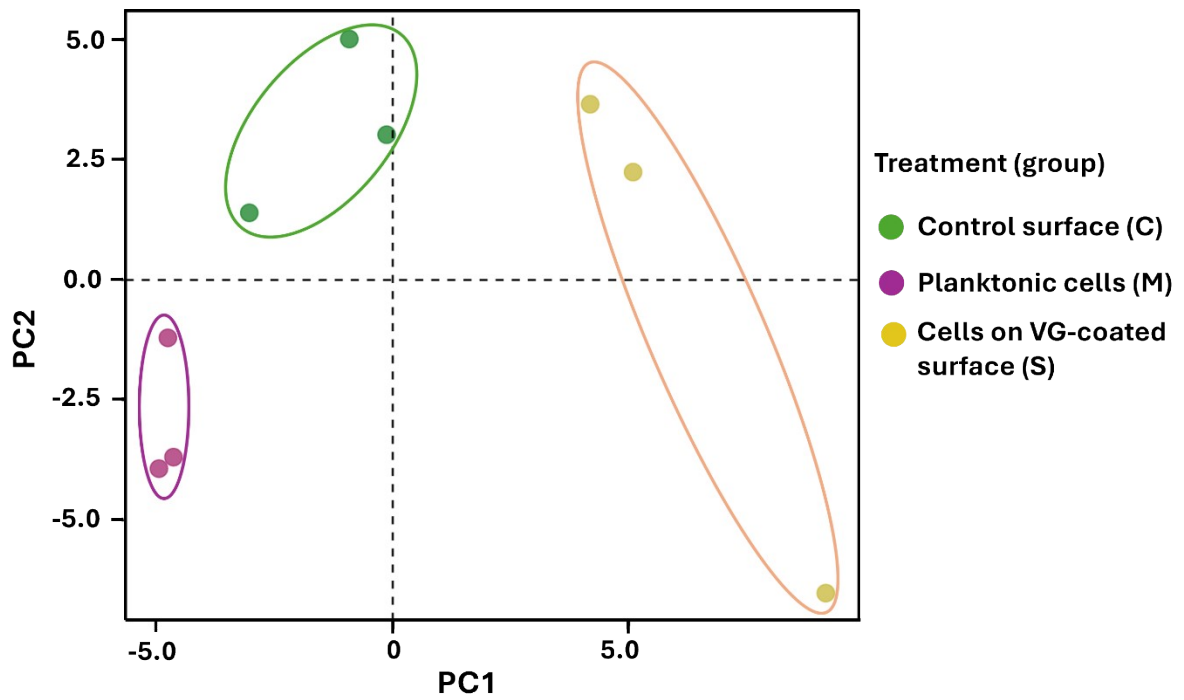
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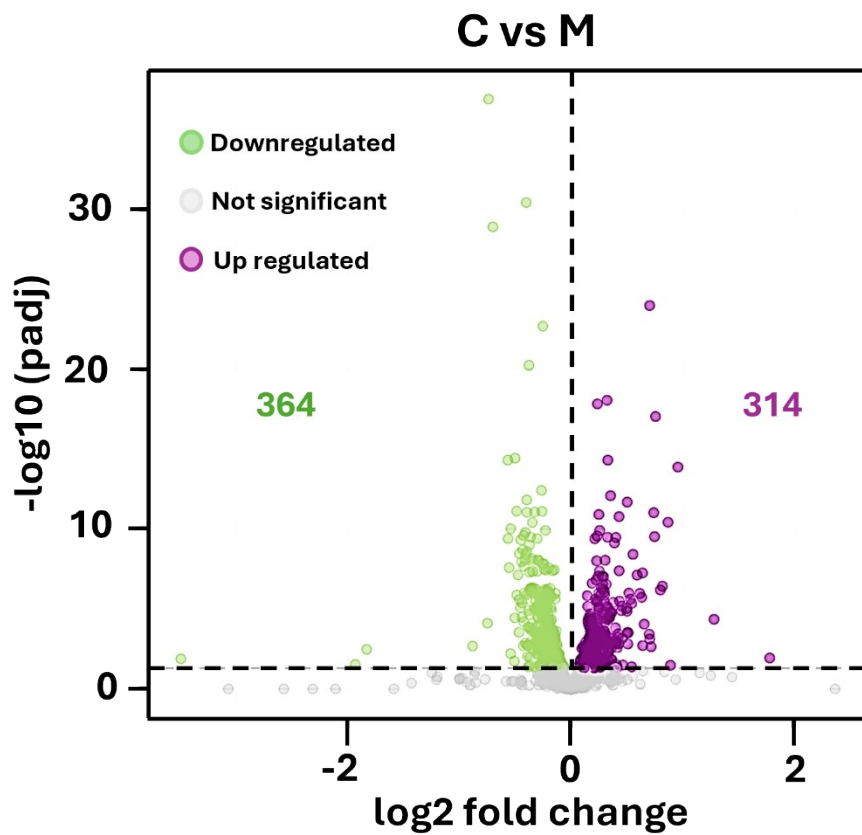
**Figure S1.** *Structural and topographical characterization of the VG coating. (A) Additional top-view SEM image of the VG coating; (B) Cross-sectional SEM image showing the continuous VG coating and its vertically oriented nanoflake-like architecture on the substrate; (C) 3D AFM topography image of the VG coating.*



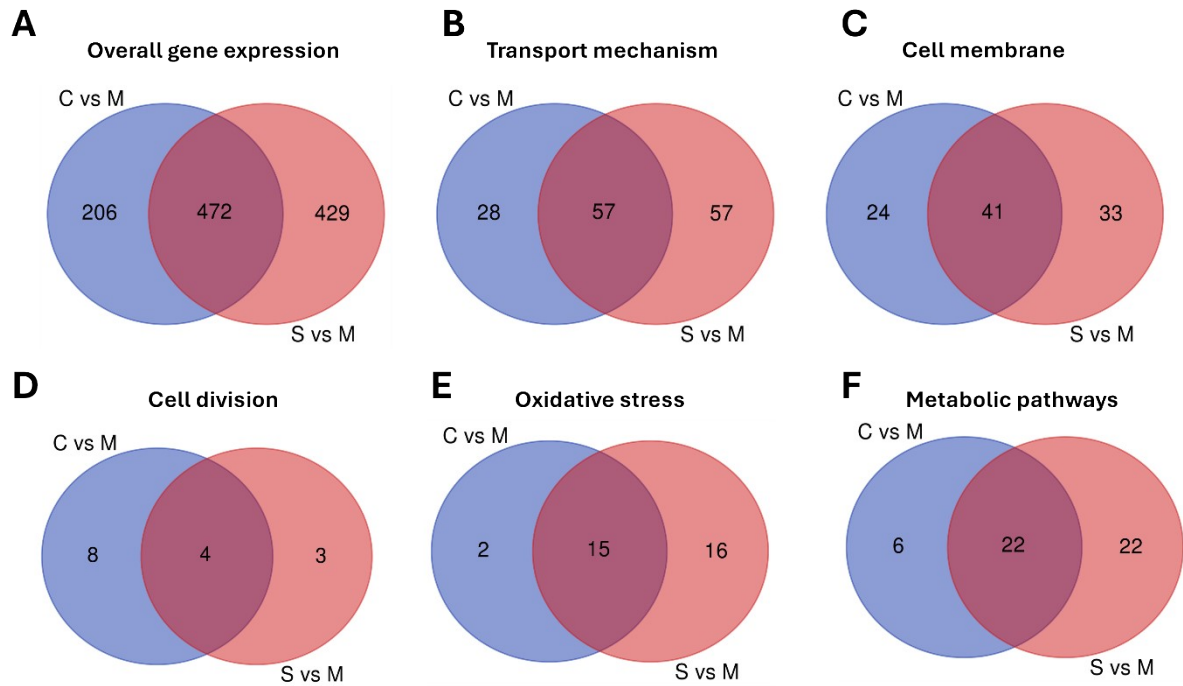
**Figure S2.** *A false coloured high magnification SEM image of *S. mutans* cells on the VG coated surface, showing a completely disintegrated, and partially damaged cells.*



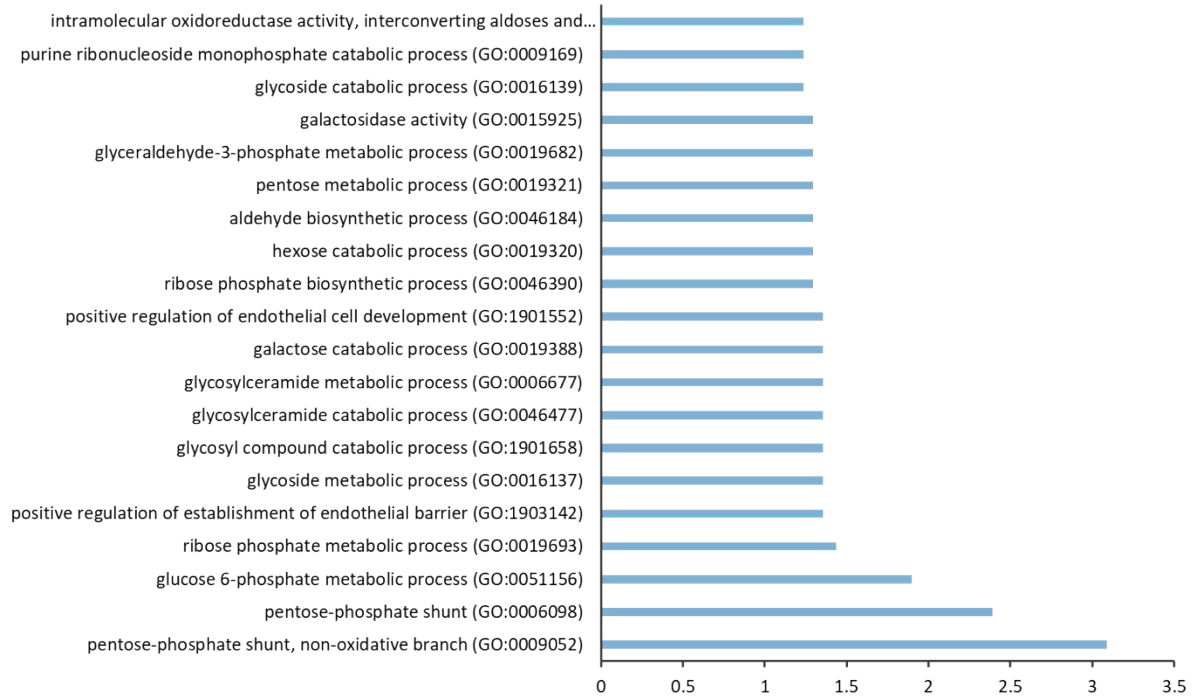
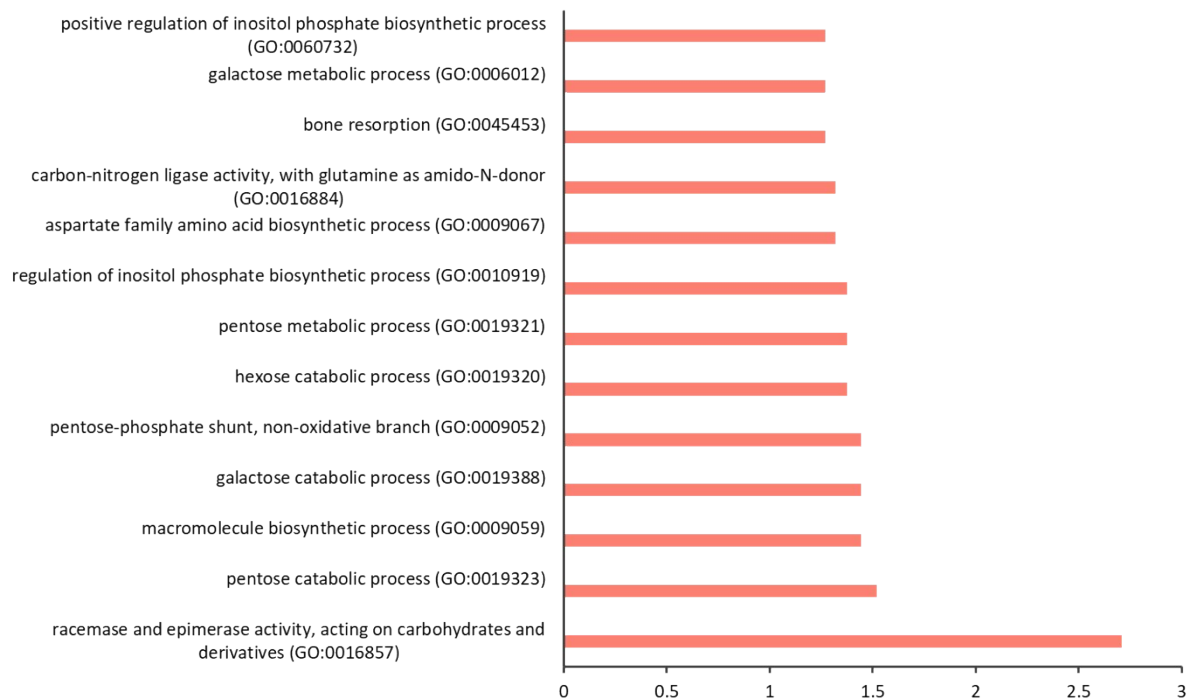
**Figure S3.** *Principle Component Analysis (PCA) showing transcriptomics expression profile in different test groups.*

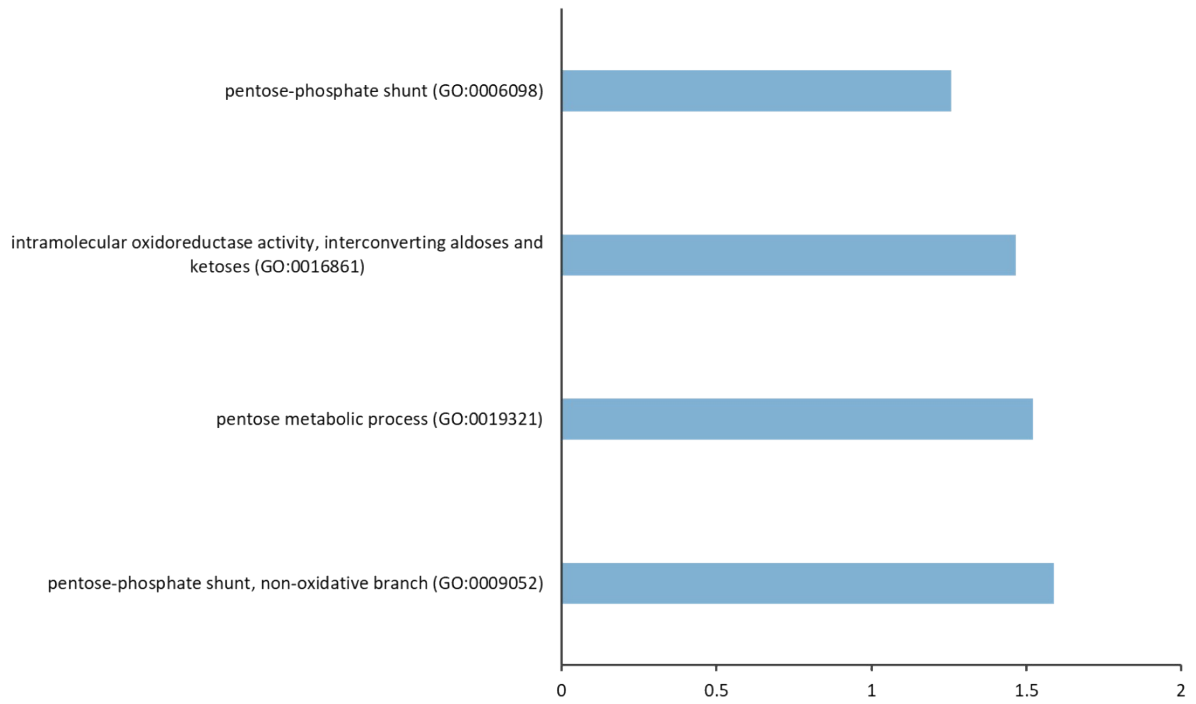
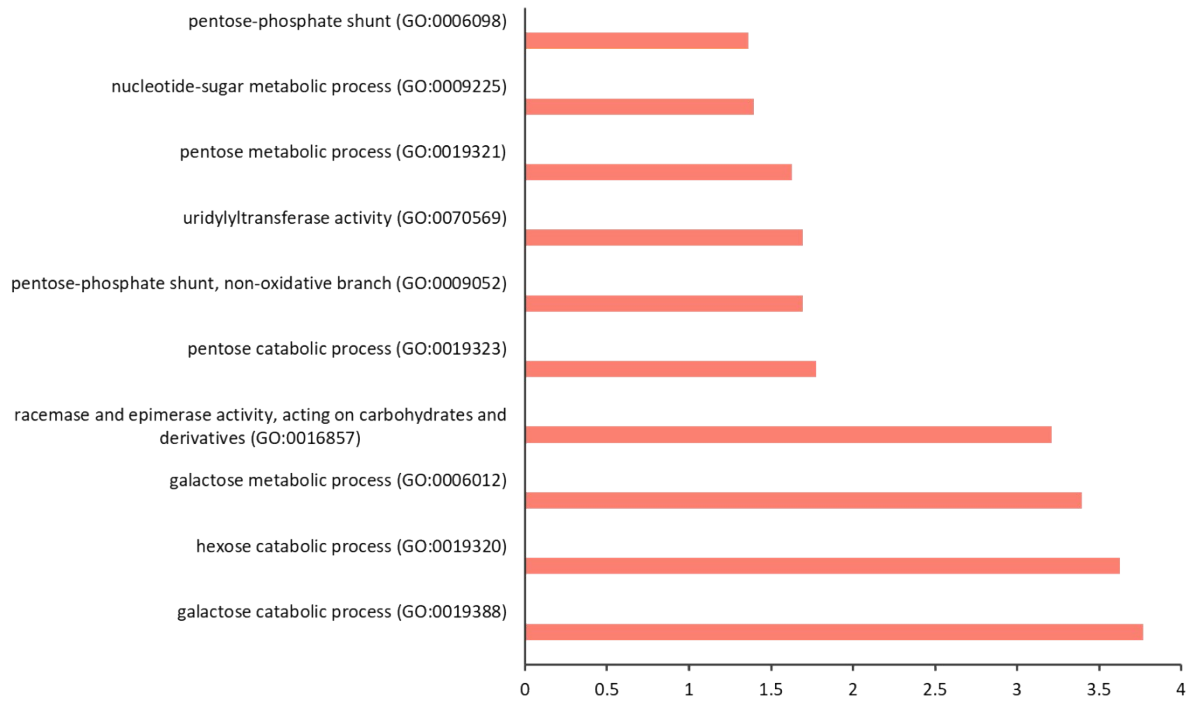


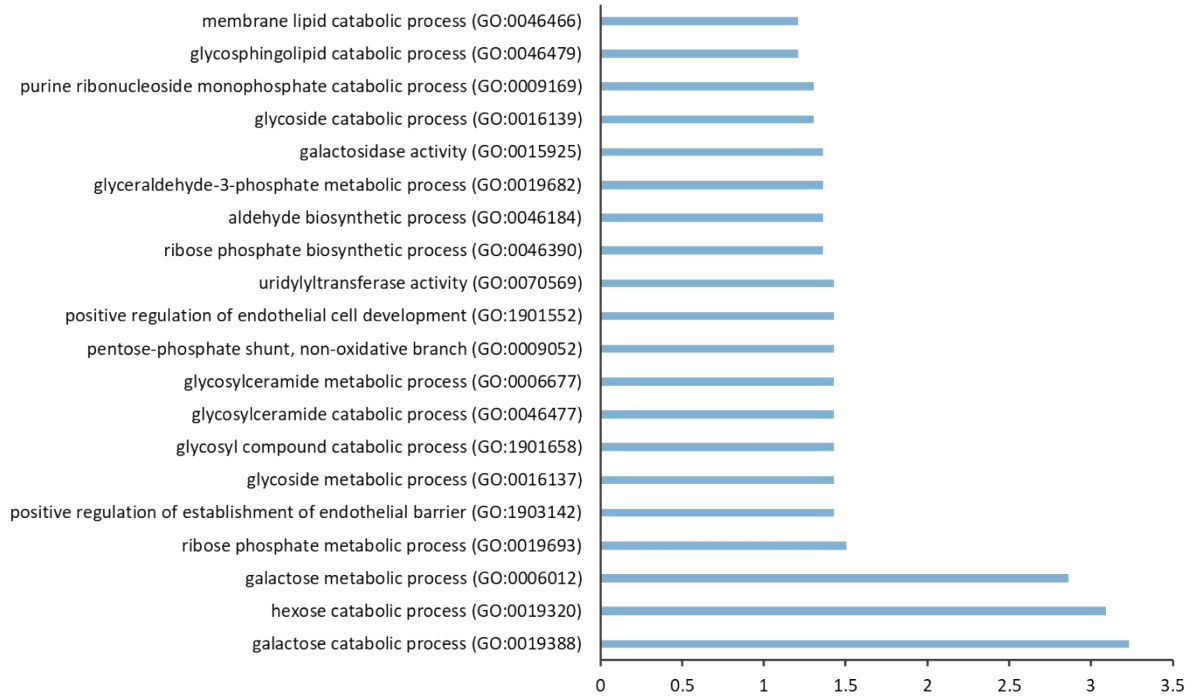
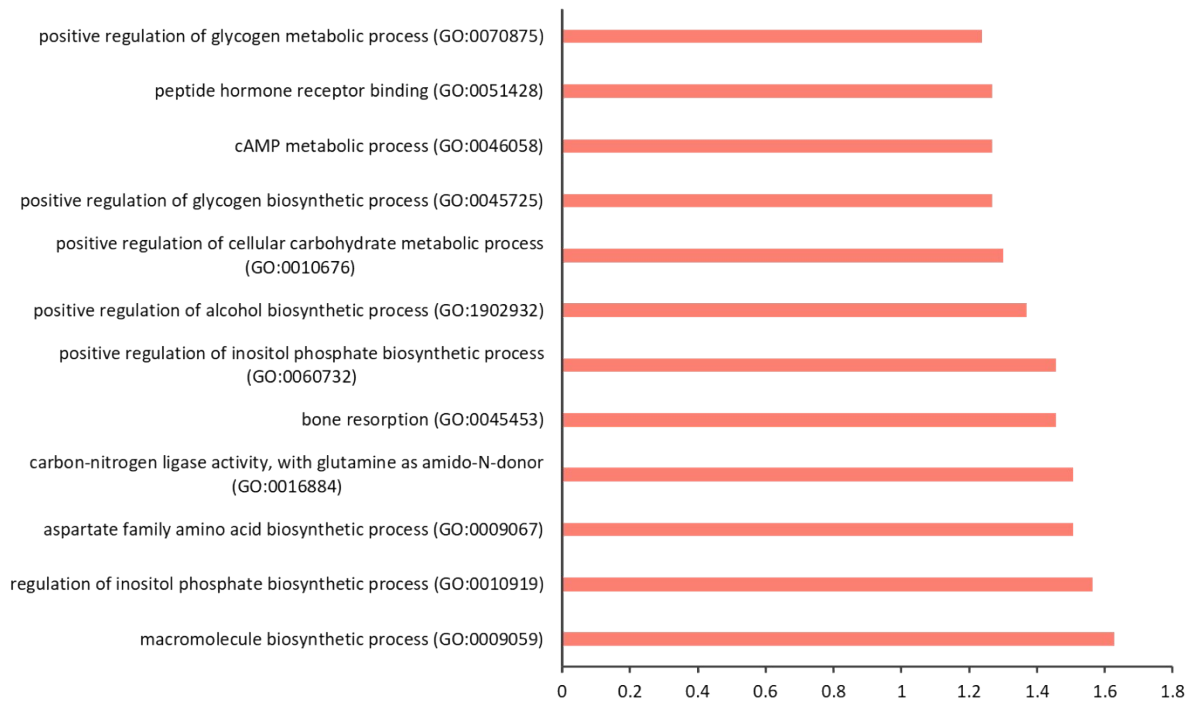
**Figure S4.** Volcano plot depicting differentially expressed genes level in *S. mutans* in control surface to *S. mutans* in planktonic state. The horizontal black dotted line represents significance threshold at  $p\text{-adj} < 0.05$ . Upregulated genes are shown in purple and downregulated genes in green.



**Figure S5.** Venn diagram depicting intersection of data – overlap of significantly regulated all genes (A) and genes involved in transport mechanism (B), genes associated to cell membrane, genes involved in cell division, oxidative stress, and genes involved in metabolic pathways between the *S. mutans* cells grown control surface versus planktonic cells and cells on VG-coated surface versus planktonic *S. mutans* cells.

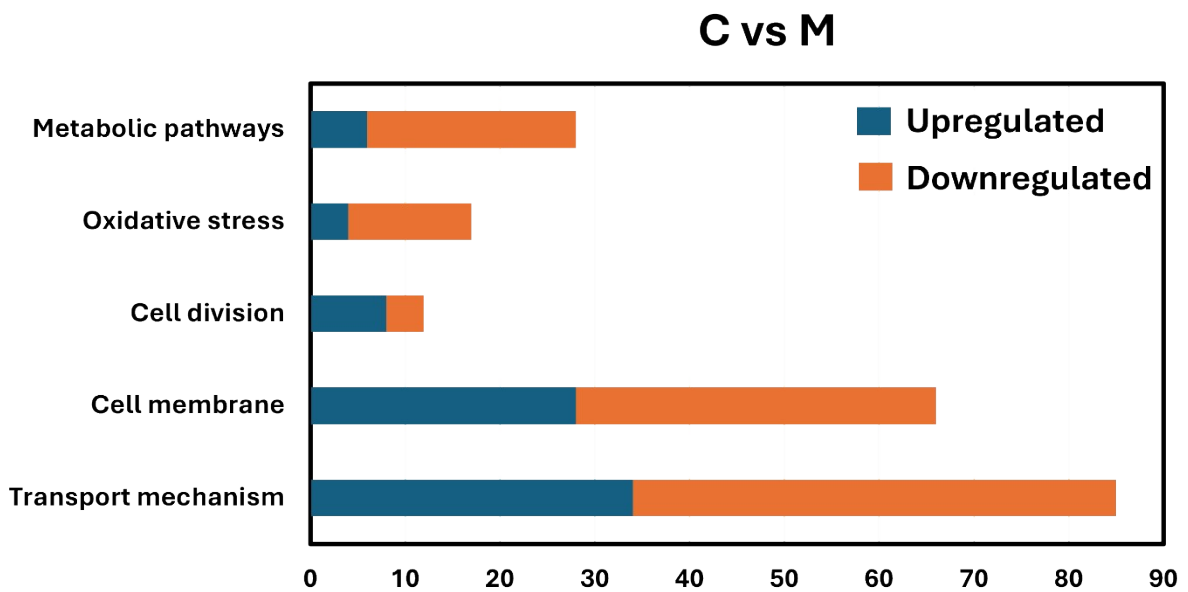
**A****S vs M downregulation****B****S vs M upregulation**

**C****S vs C downregulation****D****S vs C upregulation**

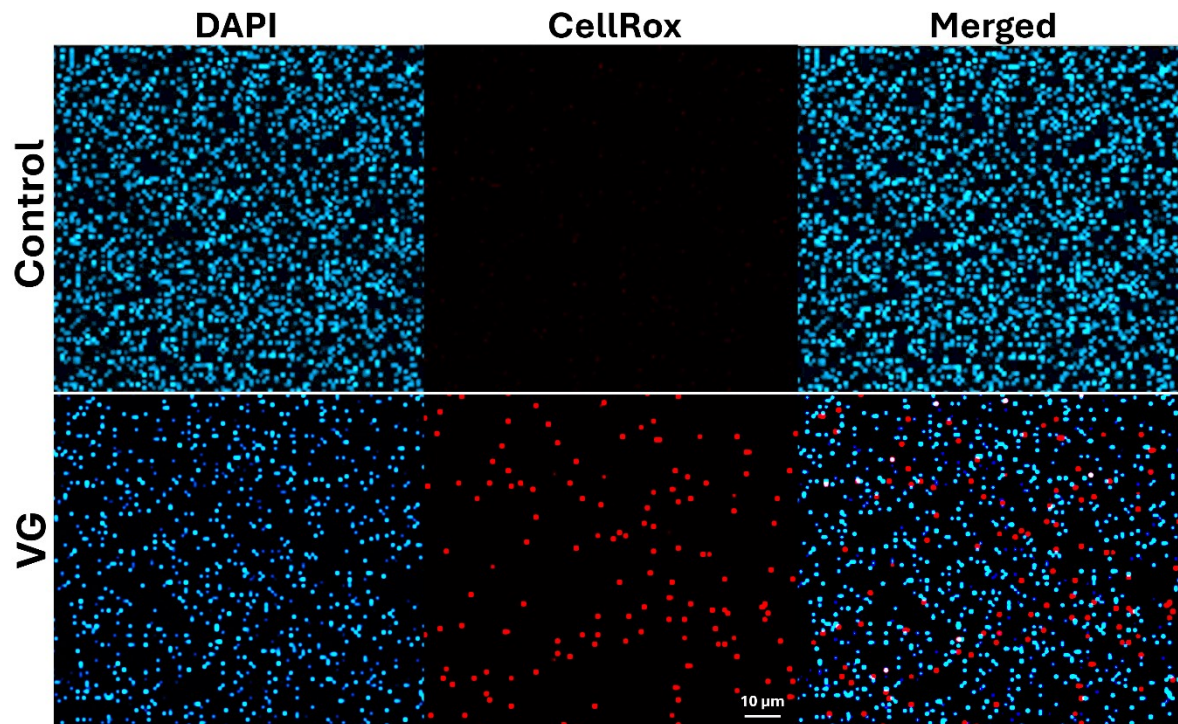
**E****C vs M downregulation****F****C vs M upregulation**

**Figure S6.** GO enrichment analysis depicting the downregulated and upregulated pathways in bacterial cells grown in vertical graphene coated surface (S) versus cells planktonic cells (M) counterpart; cells on graphene coated surface versus cells grown on uncoated surface (C);

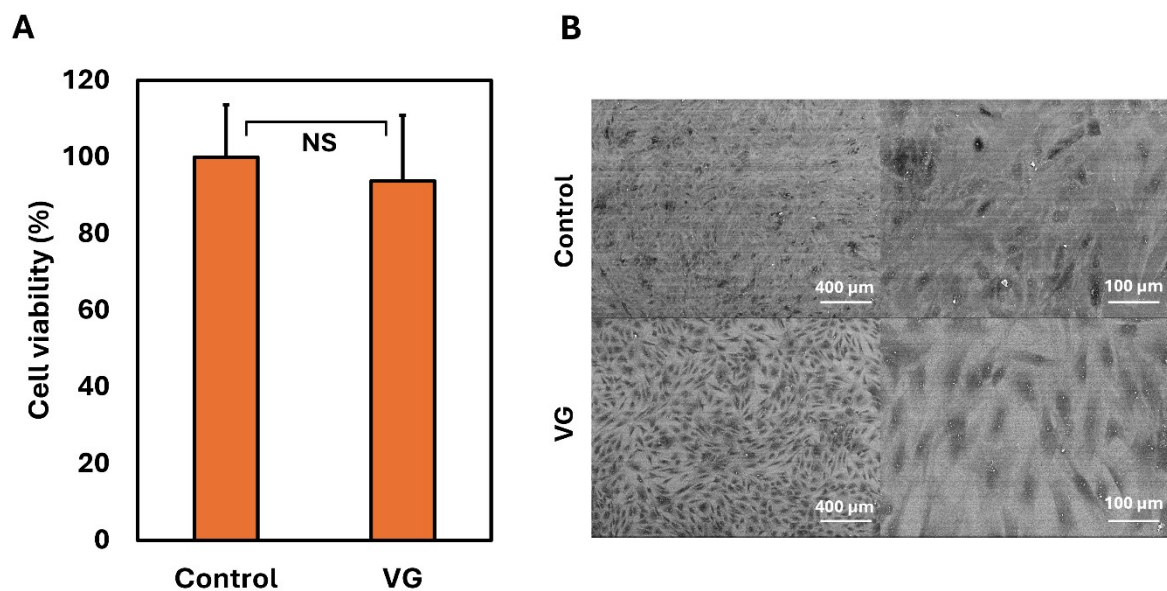
bacterial cells on uncoated surface versus planktonic cells. A) Downregulated pathways in *S* vs *M*, B) upregulated pathways in *S* vs *M*, C) downregulated pathways in *S* vs *C*, D) upregulated pathways in *S* vs *C*, E) downregulated pathways in *C* vs *M*, and F) upregulated pathways in *C* vs *M*.



**Figure S7.** Number of differentially regulated genes that are associated with transport mechanisms, cell division, oxidative stress, cell membrane synthesis and genes involved in various metabolic pathways in *S. mutans* grown on control surface in compared to planktonic cells.



**Figure S8.** Representative fluorescence microscopy images of *S. mutans* grown on control and VG coated surface stained with DAPI (nucleic acid stain) and CellRox (ROS staining). Blue indicates DAPI staining and red color indicates CellRox staining.



**Figure S9.** Biocompatibility of VG coated surfaces human osteoblast cells on control and VG coated surfaces after 48 h of growth (A). Representative SEM images of cells on the control and VG coated surfaces (B). NS: not significant ( $p > 0.05$ ).