

Supplementary Materials

Figure S1. Mixed-effects model results for Figure 2a (dose-dependent effect of MVs)

(A) Fixed effects table

Source	<i>P</i> value	Summary	<i>F</i> (<i>DFn</i> , <i>DFd</i>)
Treatment	<0.0001	****	<i>F</i> (6, 42) = 13.61
Experiment	0.9735	ns	<i>F</i> (1.611, 33.83) = 0.01271
Treatment × Experiment	0.9988	ns	<i>F</i> (12, 42) = 0.1763

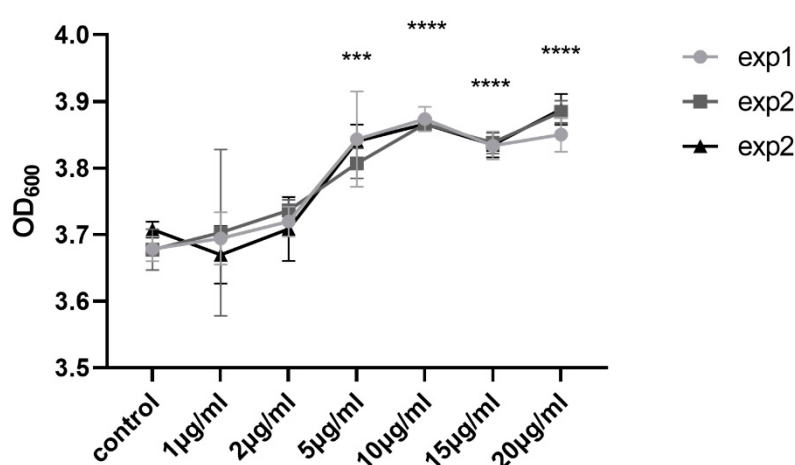
Mixed-effects model with experiment as random effect and treatment as fixed effect.

(B) Multiple comparisons (Dunnett's test vs. Control)

Comparison	Mean difference	95% CI	Adjusted <i>P</i> value
control vs. 1μg/ml	-0.001111	-0.1310 to 0.1288	>0.9999
control vs. 2μg/ml	-0.03367	-0.09252 to 0.02518	0.4029
control vs. 5μg/ml	-0.1423	-0.2210 to -0.06369	0.0008
control vs. 10μg/ml	-0.1807	-0.2203 to -0.1410	<0.0001
control vs. 15μg/ml	-0.1476	-0.1912 to -0.1039	<0.0001
control vs. 20μg/ml	-0.1862	-0.1310 to 0.1288	<0.0001

Comparison Mean difference 95% CI Adjusted *P* value

(C) Corresponding graph



Mixed-effects model analysis of the dose-dependent effect of MVs on *S. mutans* biofilm formation (Figure 2a). (A) Fixed-effects table showing the effects of treatment (MV concentration), experiment (biological replicate), and their interaction. ****, $P < 0.0001$; ns, not significant. (B) Dunnett's multiple comparisons test comparing each MV concentration to the control group. Data are from three independent experiments, each with three technical replicates. Mixed-effects model was fitted with experiment as

random effect and treatment as fixed effect. (C) Corresponding graph. ***, $P < 0.001$; ****, $P < 0.0001$.

Figure S2. Mixed-effects model results for Figure 2b (time-dependent effect of MVs)

(A) Fixed effects table

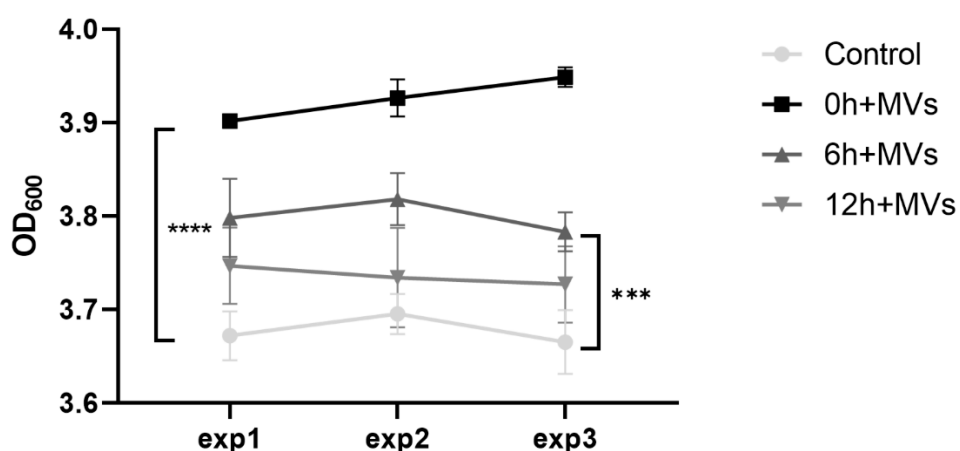
Source	P value	Summary	F (DFn , DFd)
Treatment	<0.0001	****	$F(3, 24) = 34.12$
Experiment	0.7139	ns	$F(1.394, 16.72) = 0.2337$
Treatment $\times$ Experiment	0.9160	ns	$F(6, 24) = 0.3272$

Mixed-effects model with experiment as random effect and treatment as fixed effect.

(B) Multiple comparisons (Dunnett's test vs. Control)

Comparison	Mean difference	95% CI	Adjusted P value
Control vs. 0h+MVs	-0.2483	-0.2942 to -0.2025	<0.0001
Control vs. 6h+MVs	-0.1224	-0.1797 to -0.06522	0.0001
Control vs. 12h+MVs	-0.05856	-0.1302 to 0.01307	0.1190

(C) Corresponding graph



Mixed-effects model analysis of the time-dependent effect of MVs on *S. mutans* biofilm formation (Figure 2b). (A) Fixed-effects table. ****, $P < 0.0001$; ns, not significant (B) Dunnett's multiple comparisons test comparing each time point to the control group. Mixed-effects model was fitted with experiment as random effect and treatment as fixed effect. (C) Corresponding graph. ***, $P < 0.001$; ****, $P < 0.0001$.

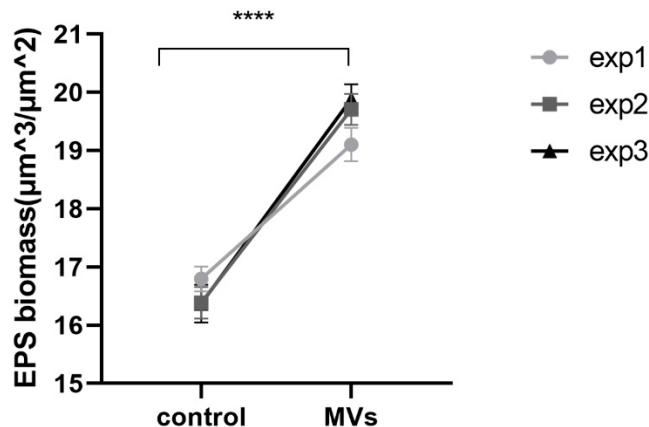
Figure S3. Mixed-effects model results for Figure 5b (EPS biovolume)

(A) Fixed effects table

Source	<i>P</i> value	Summary	<i>F</i> (<i>DFn</i> , <i>DFd</i>)
Treatment	<0.0001	****	<i>F</i> (1, 24) = 191.6
Experiment	0.7473	ns	<i>F</i> (1.553, 18.63) = 0.2222
Treatment × Experiment	0.0752	ns	<i>F</i> (2, 24) = 2.889

Mixed-effects model with experiment as random effect and treatment as fixed effect.

(B) Corresponding graph



(A) Fixed effects table. ****, $P < 0.0001$; ns, not significant. (B) Corresponding graph. ****, $P < 0.0001$. Mixed-effects model analysis of EPS biomass in *S. mutans* biofilms (corresponding to Figure 5b in the main text). The treatment effect (MV vs. Control) was highly significant ($P < 0.0001$), confirming that MV treatment significantly increased EPS production. The experiment effect was not significant, indicating good reproducibility across the three independent experiments. Mixed-effects model was fitted with experiment as random effect and treatment as fixed effect.