

SUPPORTING INFORMATION

POLLUTION ABATEMENT OF HEAVY METALS IN DIFFERENT CONDITIONS BY WATER KEFIR GRAINS AS A PROTECTIVE TOOL AGAINST TOXICITY

Giorgio Volpi^{1,*}, Marco Ginepro¹, Janeth Tafur-Marinos¹, Vincenzo Zelano¹

¹Department of Chemistry, University of Turin, Via P. Giuria 7, 10125 Turin, Italy

Tab S1. Concentration of other metals in absence and presence of sucrose (5%) for colonies 1 and 2. Conditions: $5 \cdot 10^{-3}$ M citrate buffer, initial pH= 3.5, 4.5 and 6.1, and 1:10 water kefir/metal solution ratio. Left: absence of sucrose. Right: presence of sucrose. n=3.

Tab S2. Concentration of other metals in acetate buffer ($5 \cdot 10^{-3}$ M) for colonies 1 and 2 at 1:10 and 1:1 water kefir/metal solution ratios. Conditions: 5% sucrose and initial pH= 4.5. n=3.

Tab S1. Concentration of other metals in absence and presence of sucrose (5%) for colonies **1** and **2**.
 Conditions: $5 \cdot 10^{-3}$ M citrate buffer, initial pH= 3.5, 4.5 and 6.1, and 1:10 water kefir/metal solution ratio.
 Left: absence of sucrose. Right: presence of sucrose. n=3.

| Colony | | | | 1 | | 2 | |
|---------|----------|-----|-----------|-----------------------|----------------|-----------------------|----------------|
| Element | Time (h) | pH | Sucrose % | Conc. $\mu\text{g/l}$ | Standard Error | Conc. $\mu\text{g/l}$ | Standard Error |
| Ba | 0 | 3.5 | 0 | 890 | 5 | 890 | 5 |
| | | | 5 | 890 | 5 | 890 | 5 |
| | | 4.5 | 0 | 890 | 5 | 890 | 5 |
| | | | 5 | 890 | 5 | 890 | 5 |
| | | 6 | 0 | 890 | 5 | 890 | 5 |
| | | | 5 | 890 | 5 | 890 | 5 |
| | 24 | 3.5 | 0 | 896 | 16 | 1060 | 4 |
| | | | 5 | 749 | 9 | 857 | 4 |
| | | 4.5 | 0 | 921 | 1 | 1091 | 22 |
| | | | 5 | 775 | 2 | 867 | 10 |
| | | 6 | 0 | 937 | 1 | 985 | 4 |
| | | | 5 | 771 | 3 | 855 | 2 |
| | 48 | 3.5 | 0 | 978 | 26 | 1091 | 7 |
| | | | 5 | 897 | 6 | 938 | 16 |
| | | 4.5 | 0 | 971 | 2 | 1039 | 20 |
| | | | 5 | 907 | 3 | 918 | 3 |
| | | 6 | 0 | 951 | 6 | 973 | 10 |
| | | | 5 | 870 | 4 | 929 | 2 |
| | 72 | 3.5 | 0 | 958 | 28 | 1025 | 2 |
| | | | 5 | 849 | 5 | 907 | 5 |
| | | 4.5 | 0 | 996 | 23 | 996 | 11 |
| | | | 5 | 872 | 5 | 925 | 19 |
| | | 6 | 0 | 940 | 11 | 929 | 14 |
| | | | 5 | 852 | 7 | 929 | 3 |
| Colony | | | | 1 | | 2 | |
| Element | Time (h) | pH | Sucrose % | Conc. $\mu\text{g/l}$ | Standard Error | Conc. $\mu\text{g/l}$ | Standard Error |
| Cd | 0 | 3.5 | 0 | 135 | 1 | 125 | 1 |
| | | | 5 | 135 | 1 | 125 | 1 |
| | | 4.5 | 0 | 135 | 1 | 125 | 1 |
| | | | 5 | 135 | 1 | 125 | 1 |
| | | 6 | 0 | 135 | 1 | 125 | 1 |
| | | | 5 | 135 | 1 | 125 | 1 |
| | 24 | 3.5 | 0 | 108 | 1 | 118 | 1 |
| | | | 5 | 95 | 1 | 104 | 1 |
| | | 4.5 | 0 | 108 | 0 | 115 | 1 |
| | | | 5 | 97 | 0 | 104 | 1 |

| | | | | | | | |
|----------------|-----------------|-----------|------------------|-------------------|-----------------------|-------------------|-----------------------|
| | | 6 | 0 | 102 | 0 | 95 | 1 |
| | | | 5 | 94 | 1 | 106 | 0 |
| | | 3.5 | 0 | 115 | 1 | 122 | 1 |
| | | | 5 | 106 | 1 | 105 | 1 |
| | 48 | 4.5 | 0 | 114 | 0 | 116 | 1 |
| | | | 5 | 106 | 0 | 105 | 1 |
| | | 6 | 0 | 107 | 0 | 95 | 2 |
| | | | 5 | 100 | 1 | 109 | 1 |
| | | 3.5 | 0 | 116 | 2 | 120 | 1 |
| | | | 5 | 103 | 0 | 106 | 0 |
| | 72 | 4.5 | 0 | 118 | 3 | 114 | 3 |
| | | | 5 | 104 | 0 | 106 | 0 |
| | | 6 | 0 | 107 | 0 | 89 | 2 |
| | | | 5 | 103 | 1 | 110 | 0 |
| Colony | | | | 1 | | 2 | |
| Element | Time (h) | pH | Sucrose % | Conc. µg/l | Standard Error | Conc. µg/l | Standard Error |
| Co | 0 | 3.5 | 0 | 370 | 2 | 325 | 2 |
| | | | 5 | 370 | 2 | 325 | 2 |
| | | 4.5 | 0 | 370 | 2 | 325 | 2 |
| | | | 5 | 370 | 2 | 325 | 2 |
| | | 6 | 0 | 370 | 2 | 325 | 2 |
| | | | 5 | 370 | 2 | 325 | 2 |
| | 24 | 3.5 | 0 | 290 | 3 | 312 | 1 |
| | | | 5 | 259 | 1 | 287 | 2 |
| | | 4.5 | 0 | 289 | 1 | 283 | 1 |
| | | | 5 | 270 | 0 | 291 | 1 |
| | | 6 | 0 | 284 | 9 | 246 | 13 |
| | | | 5 | 275 | 1 | 298 | 2 |
| | 48 | 3.5 | 0 | 301 | 3 | 325 | 1 |
| | | | 5 | 289 | 1 | 287 | 3 |
| | | 4.5 | 0 | 308 | 2 | 305 | 2 |
| | | | 5 | 294 | 2 | 293 | 2 |
| | | 6 | 0 | 299 | 7 | 246 | 12 |
| | | | 5 | 287 | 1 | 303 | 2 |
| | 72 | 3.5 | 0 | 302 | 4 | 322 | 3 |
| | | | 5 | 284 | 1 | 294 | 0 |
| | | 4.5 | 0 | 320 | 6 | 308 | 2 |
| | | | 5 | 289 | 1 | 292 | 1 |
| | | 6 | 0 | 300 | 6 | 242 | 12 |
| | | | 5 | 287 | 1 | 309 | 4 |

| Colony | | | | 1 | | 2 | |
|---------|----------|-----|-----------|------------|----------------|------------|----------------|
| Element | Time (h) | pH | Sucrose % | Conc. µg/l | Standard Error | Conc. µg/l | Standard Error |
| Mn | 0 | 3.5 | 0 | 5350 | 50 | 5350 | 50 |
| | | | 5 | 5350 | 50 | 5350 | 50 |
| | | 4.5 | 0 | 5350 | 50 | 5350 | 50 |
| | | | 5 | 5350 | 50 | 5350 | 50 |
| | | 6 | 0 | 5350 | 50 | 5350 | 50 |
| | | | 5 | 5350 | 50 | 5350 | 50 |
| | 24 | 3.5 | 0 | 4737 | 55 | 5185 | 19 |
| | | | 5 | 4243 | 20 | 4672 | 31 |
| | | 4.5 | 0 | 4790 | 16 | 4874 | 15 |
| | | | 5 | 4392 | 8 | 4734 | 27 |
| | | 6 | 0 | 4771 | 116 | 4388 | 172 |
| | | | 5 | 4438 | 16 | 4799 | 36 |
| | 48 | 3.5 | 0 | 4979 | 55 | 5402 | 16 |
| | | | 5 | 4761 | 22 | 4745 | 57 |
| | | 4.5 | 0 | 5116 | 45 | 5122 | 40 |
| | | | 5 | 4854 | 31 | 4820 | 37 |
| | | 6 | 0 | 4996 | 81 | 4467 | 132 |
| | | | 5 | 4704 | 6 | 4962 | 22 |
| | 72 | 3.5 | 0 | 4991 | 73 | 5301 | 37 |
| | | | 5 | 4668 | 13 | 4842 | 12 |
| | | 4.5 | 0 | 5318 | 108 | 5154 | 44 |
| | | | 5 | 4750 | 13 | 4802 | 16 |
| | | 6 | 0 | 4982 | 74 | 4412 | 116 |
| | | | 5 | 4709 | 14 | 5010 | 49 |

Tab S2. Concentration of other metals in acetate buffer ($5 \cdot 10^{-3} \text{M}$) for colonies **1** and **2** at 1:10 and 1:1 water kefir/metal solution ratios. Conditions: 5% sucrose and initial pH= 4.5. n=3.

| Colony | 1 | | | | | 2 | | | | |
|-----------|----------|-----------------------|----------------|-----------------------|----------------|----------|-----------------------|----------------|-----------------------|----------------|
| Ratio | 1:10 | | | 1:1 | | 1:10 | | | 1:1 | |
| Element | Time (h) | Conc. $\mu\text{g/l}$ | Standard Error | Conc. $\mu\text{g/l}$ | Standard Error | Time (h) | Conc. $\mu\text{g/l}$ | Standard Error | Conc. $\mu\text{g/l}$ | Standard Error |
| Ba | 0 | 890 | 5 | 890 | 5 | 0 | 890 | 5 | 890 | 5 |
| | 24 | 940 | 15 | 560 | 13 | 24 | 922 | 7 | 582 | 38 |
| | 48 | 1060 | 10 | 606 | 16 | 48 | 1044 | 4 | 619 | 6 |
| | 72 | 815 | 9 | 460 | 22 | 72 | 867 | 20 | 456 | 8 |
| Cd | 0 | 135 | 1 | 135 | 1 | 0 | 135 | 1 | 135 | 1 |
| | 24 | 131 | 14 | 81 | 1 | 24 | 116 | 1 | 83 | 4 |
| | 48 | 117 | 2 | 87 | 1 | 48 | 118 | 1 | 87 | 1 |
| | 72 | 105 | 1 | 83 | 7 | 72 | 108 | 2 | 78 | 1 |
| Co | 0 | 370 | 2 | 370 | 2 | 0 | 370 | 2 | 370 | 2 |
| | 24 | 360 | 13 | 199 | 3 | 24 | 352 | 2 | 208 | 15 |
| | 48 | 358 | 7 | 226 | 4 | 48 | 370 | 3 | 232 | 3 |
| | 72 | 301 | 3 | 199 | 20 | 72 | 312 | 5 | 190 | 2 |
| Mn | 0 | 5350 | 50 | 5350 | 50 | 0 | 5350 | 50 | 5350 | 50 |
| | 24 | 2667 | 71 | 1770 | 37 | 24 | 2747 | 114 | 1787 | 95 |
| | 48 | 2649 | 46 | 1877 | 19 | 48 | 2703 | 12 | 1920 | 17 |
| | 72 | 2289 | 19 | 1716 | 128 | 72 | 2344 | 41 | 1675 | 13 |