**Supporting Information**

**A simple, cost-effective colorimetric assay for aluminum ions via complexation with the flavonoid rutin**

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| **Table S1. Assay performance for Al3+ ion quantification at 18.0, 9.00, 4.50, and 2.25 mM rutin concentrations** | | | | | |
| **[Rutin] (mM)** | **Linear Range (μM)** | **Linearity (R2)** | **Sensitivity (nM)** | **LOD**  **(nM)** | **LoQ**  **(nM)** |
| 18.0 | 1-8 | 0.9985 | 9.3 | 225 | 751 |
| 9.00 | 1-8 | 0.9991 | 7.6 | 79.8 | 266 |
| 4.50 | 1-8 | 0.9991 | 12.8 | 248 | 827 |
| 2.25 | 1-8 | 0.9974 | 22.1 | 144 | 478 |

**1. Supplemental Figures and Tables**

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**Figure S1.** Absorption spectroscopy of rutin-aluminum chelation complexes with increasing aluminum concentration using either 18.0 mM (orange), 9.00 mM (yellow), 4.50 mM (green), or 2.25 mM (blue) rutin in dimethyl sulfoxide. A total of 22 Al3+ concentrations ranging from 7.6 x 10-3 μM to 16 mM were analyzed, where the 16 mM sample was serially diluted two-fold to create the concentration series. a) Absorbance spectra, where the unchelated rutin (355 nm) and rutin-Al3+ chelation complex (410 nm) peak are highlighted in gray. b) The ratiometric absorbance (i.e., the ratio of the 410 and 355 nm peaks, A410nm/A355nm) as a function of increasing Al3+ ion content, with the linear range displayed as an inset. The error bars are the standard deviation of *n* = 3 measurements.

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**Figure S2.** Absorption spectroscopy of mono- (lithium, sodium, potassium), di- (magnesium, calcium, manganese, nickel, copper, zinc), and tri-cations (iron) analyzed using the rutin colorimetric assay (i.e., with a rutin concentration of 9 mM). A reference that does not contain Al3+ (gray) and an 8 uM Al3+ sample (black) are provided for reference. The cations were analyzed at 8 μM (orange), 80 μM (green), and 800 μM (purple) concentrations.

**Graphical user interface

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**Figure S3.** Visual representation of the colored, rutin-metal chelation complexes formed with mono- (lithium, sodium, potassium), di- (magnesium, calcium, manganese, nickel, copper, zinc), and tri-cations (iron) using a 9 mM rutin solution.

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**Figure S4.** Representation of the alginate complexation of Al3+ ions, resulting in the formation of a stable, mechanically robust gel.

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**Figure S5.** Absorbance spectra of a water blank (black), 0.001% (w/v) alginate solution (orange), and 0.001% alginate solution after filtration (red).