**SUPPLEMENTARY INFORMATION**

1. Clay type in Tailings 1 and 2 as identified by Rigaku Ultima IV X-Ray Diffractometer.
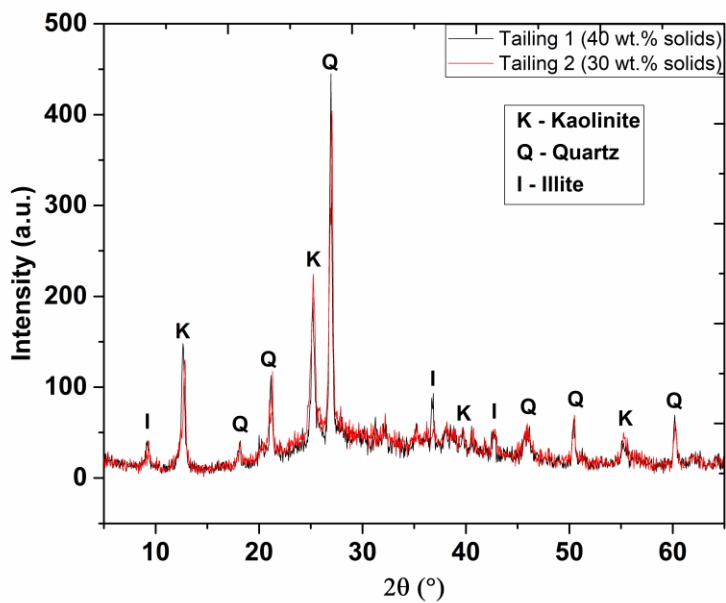


**Figure S1.** XRD of Tailings 1 and Tailings 2

2. The table given below shows the water chemistry analysis of water which was vacuum filtered from tailings.

**Table S1.** Water chemistry, electrical conductivity, pH and alkalinity of tailings water samples

| Tailings Water Samples | Electrical Conductivity (μS/cm) | Cations (mg/l) | | | | | | Anions (mg/l) | | | | pH | Alkalinity (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Ca | Fe | K | Mg | Mn | Na | Cl | $NO_3$ | $NO_2$ | $SO_4$ | | |
| Tailings 1 | 115 | 0.580 | 0.017 | 0.491 | 0.167 | 0.001 | 2.076 | 1.20 | 0.49 | 0.43 | 0.61 | 7.65 | 363 |
| Tailings 2 | 15.1 | 0.230 | 0.002 | 0.012 | 0.061 | 0 | 0.137 | 0.44 | 0.48 | 0 | 0.52 | 7.26 | 90 |

3. The results given below support discussions in section 3.2 about loose and strong aggregates formed post AC electrical treatment in Tailing 2. Tailings 2 had lower solids content (30 wt.%) and lower electrical conductivity (15μS/cm). The results of variation patterns of electric field and current density with time for formation of loose and strong aggregation for all frequencies for Tailings 2 is given in Figure S2 (A) and (B) respectively. Further comparisons about nature of variation of the electrical parameters on aggregation for Tailings 1 and 2 are elaborated in section 3.2.
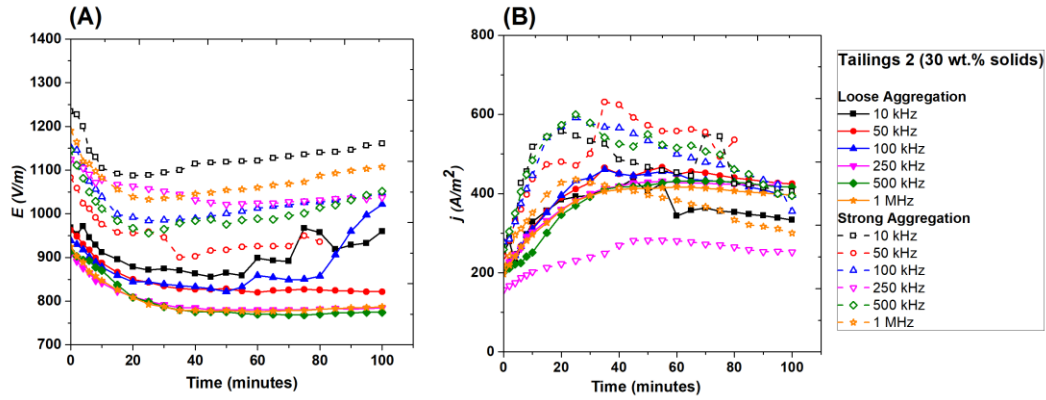


**Figure S2.** Alternating electric energy patterns for loose & strong aggregation in Tailings 2. (A) Electric Field Trends, (B) Current Density Trends. All results are based on experiments conducted with rectangular electrodes.

4.  The results given below support discussions about dewatering in section 3.4. Figure S3 (A.1 and A.2) discuss the electric field and current density trends respectively for Tailings 2 during loose aggregation when dewatering experiments were conducted in electrode configuration given in Table S3 (B). The trends for strong aggregation in the same is given in Figure S3 (B.1 and B.2)
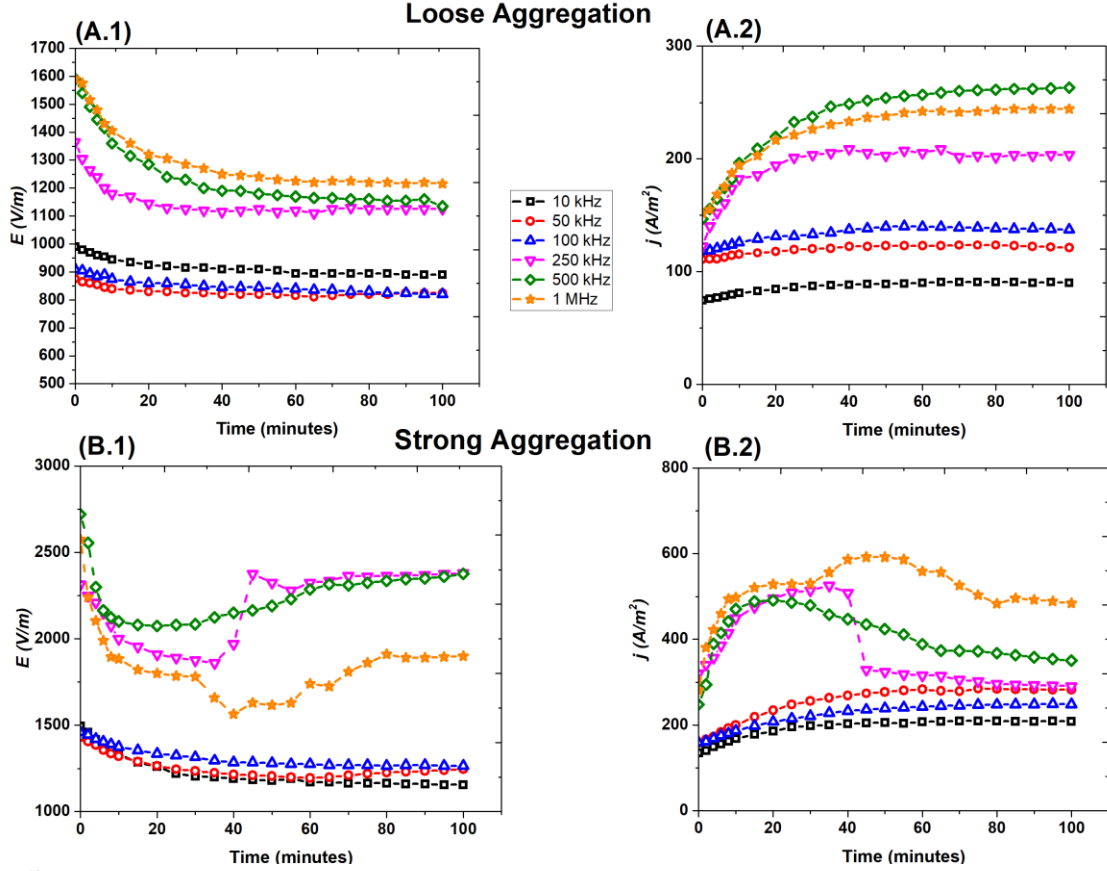


**Figure S3.** Dewatering results post electrical aggregation of Tailings 2. (A.1) Electrical field trend (A.2) Current density trend on loose aggregation, (B.1) Electrical field trend (B.2) Current density trend on strong aggregation. All results are based on experiments conducted with rectangular electrodes.