Comprehensive Environmental Solutions, Inc.

PROCESS POTENTIAL STUDY

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Effect of New Mex Humate Leachate Treatment on Heavy Metal Removal

AIM:

Our purpose is to measure the ability of New Mex Humate leachate to remove heavy metals from treated industrial process waste streams. We are attempting to find a finishing treatment that can reduce the concentration of some of the more problematic elements, such as cobalt, nickel, tin and zinc.

SCOPE:

A waste stream composite sample is spiked with all thirteen regulated elements. This material is then analyzed and used as a baseline to examine varying levels of humate leachate additions. These results, in turn, will be compared to other treatment options at a later date.

SAMPLE PREPARATION:

Several portions of wastewater, taken in April 2004, were combined into one sample and dubbed "April Composite". The sample was then spiked with all thirteen regulated elements, to a level of 0.2 ppm, and then adjusted to a pH of 7 with caustic and sulfuric acid. The pH adjustment resulted in the formation of a precipitate. This material was mixed, suspended and rapidly separated into six subsamples. The first sample is this raw pH adjusted suspension. The next sample was centrifuged to remove all solid particles. This material used as a baseline to compare against all subsequent treatments. The last four samples were composed of the April Composite with increasing additions of humate leachate.

Identification	**Treatment**	**Description**	
Sample #1:	None	50 ml raw sample	Uncentrifuged
Sample #2:	None	50 ml sample	Centrifuged
Sample #3:	Humate Leachate0.5%	0.25 ml Humate Leachate + 50 ml raw sample	Centrifuged
Sample #4:	Humate Leachate 1%	0.5 ml Humate Leachate + 50 ml raw sample	Centrifuged
Sample #5:	Humate Leachate 5%	2.5 ml Humate Leachate + 50 ml raw sample	Centrifuged
Sample #6:	Humate Leachate 10%	5.0 ml Humate Leachate + 50 ml raw sample	Centrifuged

These samples were prepared for analysis by taking a 50 ml aliquot of each and adding 2 ml of 1:1 nitric acid and 1 ml of 1:1 hydrochloric acid. These samples were heated to a gentle boil, digested, cooled and then diluted back to their original volume.

ANALYTICAL RESULTS:

All samples were analyzed for the thirteen key elements and iron on a Leeman Labs, Model Profile Plus ICP Spectrometer. All results are given in units of part per million (ppm).

Element / Symbol		April Composite pH 7 Raw Uncentrifuged	April Composite pH 7 Centrifuged	April Composite pH 7 Humate Leachate 0.5%
Antimony	**Sb**	0.254	0.165	0.124
Arsenic	**As**	0.281	0.086	0.049
Cadmium	**Cd**	0.229	0.098	0.054
Chromium	**Cr**	0.309	0.120	0.077
Cobalt	**Co**	0.487	0.479	0.455
Copper	**Cu**	0.278	0.138	0.089
Lead	**Pb**	0.261	0.159	0.117
Nickel	**Ni**	4.25	4.49	4.31
Silver	**Ag**	0.323	0.148	0.039
Tin	**Sn**	0.530	0.172	0.098
Titanium	**Ti**	0.257	0.106	0.053
Vanadium	**V**	0.271	0.158	0.089
Zinc	**Zn**	1.94	0.813	0.693
Iron	**Fe**	37.9	24.6	13.3

ND = Not Detected

Element / Symbol		April Composite pH 7 Humate Leachate 1%	April Composite pH 7 Humate Leachate 5%	April Composite pH 7 Humate Leachate 10%
Antimony	**Sb**	0.119	0.097	0.090
Arsenic	**As**	0.043	0.039	0.037
Cadmium	**Cd**	0.054	0.048	0.047
Chromium	**Cr**	0.081	0.072	0.070
Cobalt	**Co**	0.455	0.423	0.403
Copper	**Cu**	0.095	0.085	0.082
Lead	**Pb**	0.124	0.106	0.112
Nickel	**Ni**	4.25	3.96	3.86
Silver	**Ag**	0.039	0.032	0.041
Tin	**Sn**	0.099	0.082	0.080
Titanium	**Ti**	0.057	0.050	0.049
Vanadium	**V**	0.089	0.080	0.080
Zinc	**Zn**	0.688	0.623	0.612
Iron	**Fe**	14.4	12.8	11.1

ND = Not Detected

PERCENT HEAVY METAL REDUCTION AT 0.5 % HUMATE LEACHATE ADDITION

Silver	74%	**Arsenic**	43%	**Antimony**	25%
Titanium	50%	**Tin**	43%	**Zinc**	15%
Iron	46%	**Chromium**	36%	**Cobalt**	5%
Cadmium	45%	**Copper**	35%	**Nickel**	4%
Vanadium	44%	**Lead**	26%		

CONCLUSIONS:

- The humate leachate treatment resulted in measurable reductions in all fourteen elements tested elements.
- The greatest reduction in heavy metal concentration occurred following the 0.5% humate leachate addition.
- Higher additions of humate leachate do not substantially improve the situation. The humate leachate alone is effective only up to a 0.5 % addition.
- Significant reductions occurred, in the levels of silver, titanium, iron, cadmium, vanadium, arsenic and tin.
- Marginal reductions occurred in the levels of chromium, copper lead and tin.
- Humate leachate alone is not an effective treatment for zinc, cobalt and nickel.
- Of the four most problematic elements, only tin is substantially improved by this treatment.

RECOMMENDATIONS:

- Investigate the effect of humate leachate additions, between the range of zero to 0.5 %.
- Compare humate leachate to other treatments.
- Evaluate the combination of humate leachate with other treatment chemicals.