Micro-Tracers Inc.
1370 Van Dyke Avenue, San Francisco, California 94124 USA
Tel: (415)822-1100 Fax: (415)822-6615 Website: www.microtracers.com

Quality Assurance With Microtracer F

PRINCIPLES:

Microtracers™ F (colored uniformly sized iron particles) are easily identifiable "harmless markers" used to assure the quality of mixed formula animal and poultry feeds. When formulated in vitamin, mineral or medicated premixes, a Microtracer™ serves to mark the presence of the premix in the finished feeds.

Finished feeds then contain both the coded microingredient and the Microtracer™. *Samples* of the premix and the finished feed can be assayed for the Microtracer qualitatively in two minutes and quantitatively in five minutes with no reagent other than water or alcohol required. The Microtracer result can then be used as an excellent indicator for the coded microingredient.

When assayed quantitatively, Microtracers F can be used to document efficacy of mixing as well as adequacy of batch to batch "cleanout" of mixers and other feed manufacturing equipment.

Microtracers F are isolated from feed samples either utilizing a Mason Jar with magnetic lid or *a* Microtracer™ "Rotary Detector" magnetic separator. With the "Rotary Detector" samples as large as 500 grams may be assayed routinely.

SPECIFICATION:

Microtracers F consist of iron grits (95% passing 35 mesh and 95% retained on 120 mesh) coated with one or more natural or artificial food colors stabilized with sodium carbonate. Colors include Blue, Red, Orange, Green and various combinations. Each tracer is distinguishable from others. Natural plant pigments and color additives to feeds do not interfere with the Microtracer™ analysis as these are not magnetically attractable. Microtracers F withstand pelleting and remain stable in finished mash or pelleted feeds for six months or longer. Certain Microtracers F may not be stable in premixes containing high concentrations of propylene glycol, choline hydrochloride or added water. Microtracers™ should be pre-tested to confirm stability in specific premixes.

Microtracers F have a specified count of 25,000 particles per gram. In practice, the tracer count will fall in the range 22,000 to 32,000 particles per gram.

Microtracers F are designed to avoid loss to magnetic separators in feedmills although 5% is typically lost to such magnets.

Tracer recovery from feeds averages 100% from a mixer to which they have been directly added, 80% from finished mash feed at loadout and 65% for pelleted feed at loadout. (These

recoveries assume use of a "Rotary Detector" utilizing the "Quantitative Particle Count Assays" (literature items "A-2" and "A-3"). Recoveries using a Mason Jar with magnetic lid are only qualitative).

APPLICATIONS AND AMOUNT TO USE:

1. Routine Identification of Premixes in Finished Feeds

Premixes should be formulated to yield 5 grams of tracer per 2,000-lbs. of finished feed. If a premix is added to the feed at one pound per ton, then 5 grams of tracer should be formulated per pound of premix. This will yield a "theoretical" count of 9 tracer particles per 65 grams of feed (25,000 particles multiplied by 5 grams divided by 2,000 and again by 65/455), an amount that can be conveniently analyzed utilizing a Mason Jar with magnetic lid. If tracer recovery for a pelleted feed is 65%, then on an average test one would find 6 tracer particles. If a feed is completely mixed and one expects to find six tracer particles, the likelihood of finding none based on Poisson statistics would be less than 1 in *100* tests.

For greater confidence and to measure "carryover" of premixes coded with Microtracers F, one should use a "Rotary Detector" to test for Microtracer(s). This permits complete tracer recovery and analysis of larger feed samples (i.e. 500 grams). The chances of obtaining a "false negative" (coded premix present at formulated level but no tracer found) will be nil. The likelihood of finding at least one tracer particle if 10% "carryover" of the premix to a non-target feed occurs will be better than 95%.

2. Mixer Efficiency

To determine completeness of mix, formulate Microtracers F at 50 grams of tracer per 2,000-lbs. of feed. Two or even three different colored tracers may be formulated into one batch, with the tracers added at different times or locations. In this way, two or three sets of data may be obtained from one test and mixing efficiency for two or three mixing times measured from one set of samples.

One must use a "Rotary Detector" to obtain quantitative information. Usually, one will analyze 75 gram feed samples obtaining tracer counts of about 100 particles for each color. A series of such counts from a "perfectly" mixed feed will yield a coefficient of variation (CV) of about 10%. If 10 samples are taken from a batch and one finds a 20% coefficient of variation, this will evidence a "statistically significant" deviation from complete mixing. Please refer to literature item **"**A-4 The Use of Microtracers to Determine Completeness of Mix".

3. Product Identification

Microtracers F may be formulated at 5 grams per ton to code a feed as proprietary. This is useful in protecting patent or distribution rights, in servicing improper product liability claims or requests for services and in controlling use of proprietary feed (i.e. misuse of feed by contract growers) Micro-Tracers, Inc. can supply "exclusive" tracers where necessary and tracer usage is substantial.

QUALITATIVE DETECTION PROCEDURE - MASON JAR TECHNIQUE:

A. Materials

1) A scale suitable for weighing 65 grams (2-1/2 oz) of feed.

(If this is unavailable, feed may be measured volumetrically in the Mason Jar itself. (1/2/ Jar roughly equals 65 grams)

2) Whatman #1 filter paper, 7.0 cm circles

3) For pelleted feeds, a coffeemill or osterizer

4) A dropper bottle

5) Water (often with one drop ammonia per 100ml) or a 60% ethanol water solution, depending upon the tracers to be tested.

6) For pelleted feeds, a coffeemill or osterizer

7) A special magnetic lid (supplied by Micro-Tracers, Inc)

B. Method

1) Prepare pelleted feeds for analysis by grinding them to mash

2) Transfer 65 grams of feed to Mason Jar

3) Insert one sheet of filter paper into special magnetic lid and screw lid onto Mason Jar.

4) Shake the jar for one minute, exposing all feed to the magnetic lid

5) Remove the lid, placing it upside down with the filter paper fully exposed.

6) Place five to ten drops of developer (water or water/alcohol) in the center of the exposed filter paper so the developer diffuses through the ring of iron particles on the filter paper. When color begins to develop (or after one minute), the paper can be transferred to a mug warmer and dried. For certain pelleted feeds, "steaming" on a hot plate may be necessary to melt fat coating the tracer particles allowing the dye from the tracer particles to dissolve on the filter paper.

Total Elapsed Time: Less than 2 minutes

QUALITATIVE DETECTION PROCEDURE - _ROTARY DETECTOR TECHNIQUE:

A .Materials

In Addition to those required by the Mason Jar Technique

1) A "Rotary Detector" magnetic separator

2) A bulk tape eraser to "demagnetize" tracer particles

3) A 30 ml weigh analytical scoop

4) An artists "fan" brush or equivalent

5) Whatman #1 filter paper, 15 or 18.5 cm circles or equivalent (coffee filters or paper towels may be adequate)

6) Large hot plate or oven

B. Method

1) Prepare pelleted feed samples for analysis by grinding them to mash

2) Remove top hopper of "Rotary Detector" from the base cabinet.

3) Place 7.5 cm filter paper with center hold cut on pin of mounted motor on base cabinet

4) Place top hopper of "Rotary Detector" back on the base cabinet.

5) Turn power on. The magnet at the center of the "Rotary Detector" should rotate gaining speed until the unit shakes.

6) Pour the feed sample (as much as 500 grams) through the upper hopper of the "Rotary Detector". If the hopper plugs, agitate the feed in the hopper by probing it with the artists fan brush.

7) When the feed has cleared the upper hopper, remove it exposing the filter paper with entrapped iron.

8) Apply five to ten drops of developer (water or water/alcohol) to the center of the filter paper and turn on power without replacing upper hopper. The magnet will rotate and the solvent will disperse through the paper leaching dye from the tracer particles onto the paper. Turn power off. Dry the test paper.

Total Elapsed Time: Less than 2 minutes

Note: For quantitative results, see Microtracer™ literature item “A-3”.

Updated: 07-22-13 ZE