



Radioactive measurement: Combustion or Dissolution

Radioactive measurement of feces, blood, liver, brain or fat tissue A Comparison of Dissolution with Combustion

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Abstract

Combustion of tissue is the most used technique to determine the amount of radioactivity. This combustion technique is very labour intensive and therefore a search for alternatives was made. Feces and blood were directly dissolved with Soluene® 350. Liver, brain and fat were dissolved with Soluene® 350 and the Adaptive Focused Acoustics wave technique of Covaris.

The solubility technique gave a recovery of 95-110% of the values found with combustion.

Introduction

To measure the amount of radioactivity in feces, blood, liver, brain or fat samples, it is necessary to process these samples before submitting them to liquid scintillation counting. As an alternative to sample combustion, these samples may be dissolved.

Feces samples were obtained from rats dosed with a ¹⁴C labeled compound and liver, brain and fat samples were obtained from a dog dosed with the same ¹⁴C labeled compound. Blank rat blood was spiked with a ¹⁴C labeled compound.

Covaris instrument

The Covaris Adaptive Focused Acoustics (AFA) process works by sending acoustic energy wave packets from a dish-shaped transducer (figure 1) that converges and focuses to a small-localized area, creating intense mixing. At this focal point, the energy density may be controllably focused into the sample of interest¹ (figure 2). The Covaris acoustic transducer operates at 500kHz with a wavelength of ~1mm, unlike conventional sonics which has a wavelength of ~100mm. This enables the acoustics energy to be exactly directed in a non-contact and isothermal mode.

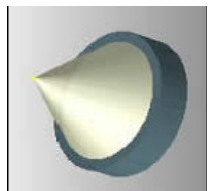


Fig. 1

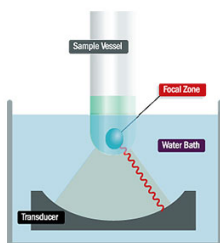


Fig. 2

Sample preparation

Combustion

Of each sample 200 mg was weight in duplicate in combustion cones. Radioactivity in the weighed aliquots was determined after combustion and trapping of liberated ¹⁴CO₂ in an alkaline medium, and addition of a suitable liquid scintillation cocktail to the entrapment medium with liquid scintillation counting.

Dissolution (feces and blood)

- Add 2 ml Soluene® 350 to each glass scintillation vial including backgrounds
 - Place samples in an oven (45-55°C) for 72hrs
 - Cool samples to room temperature add 15 ml Hionic-Fluor™
- Let the samples stand overnight prior to liquid scintillation counting

Covaris (liver, brain and fat)

- Add 2 ml Soluene® 350 to each glass scintillation vial including backgrounds
- Place samples overnight in an oven (45-55°C)
- Place samples in the Covaris with a cycle of 10 seconds on 10 seconds off for 5 minutes
- After cooling samples to room temperature add 15 ml Hionic-Fluor™ to each vial
- Let the samples stand overnight prior to liquid scintillation counting

Criteria

The recovery was calculated by dividing the measured radioactivity after dissolving with the measured radioactivity after combustion. The dissolution procedure was accepted if the recovery was 100%±10% of the values found with combustion.

Results

The amount of radioactivity was determined with combustion and dissolution / Covaris for all tissues. In figure 3 the measured amounts are given.

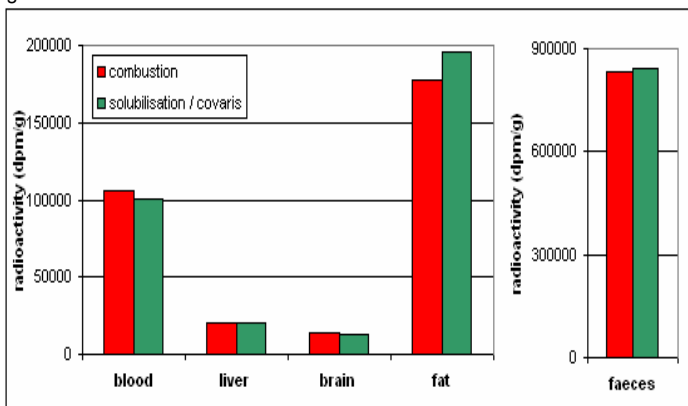


Figure 3: measured radioactivity with combustion or dissolution / Covaris in the different tissues

Table 1: Recovery

Description	recovery (%)
Faeces	101
Liver	100
Brain	96
Fat	110
Blood	95

The recovery was calculated as described in section criteria, the results are given in table 1. the solubility technique gives a recovery of 95-110% of the values found with combustion.

The reproducibility was determined by calculating the variation coefficient and was <5% (feces and blood n=5; liver, brain and fat n=3).

Conclusion

- Direct dissolving blood and feces followed by LSC gave comparable values (95% and 101% resp.) when compared to combustion results
- Dissolving liver, brain and fat tissue with Adaptive Focused Acoustics and measured with LSC gave comparable values (100%, 98% and 110% resp.) when compared to combustion results
- Time saving and simple in use
- Combustion can be replaced by dissolution with only Soluene® 350 (feces and blood) or together with Covaris (other tissues)

References

1. website http://www.covarisinc.com/how_it_works.htm