

Dry Grinding Hair using the Bead Ruptor Elite

Protocol Snapshot

Summary

Hair is a sample matrix that allows for non-invasive, fast and simple sampling. Small molecules including drug metabolites and hormones, proteins, and DNA can be extracted from hair samples from a wide variety of species. Extraction efficiency is low, so laboratories often turn to bead mill homogenization to reduce particle size prior to carrying out further sample preparation procedures.

The Bead Ruptor Elite has been used in labs around the world to improve reproducibility, increase extraction efficiency, and semi-automate laboratory sample prep procedures related to hair analysis. These protocols provide starting points for optimizing a hair dry grinding procedure which can be used prior to downstream analysis by GC-MS, LC-MS/MS, DNA sequencing and other methodologies. Up to 720 hair samples can be processed in only one hour using the Bead Ruptor Elite with 2 mL Tube Carriage Kit.

Materials and Methods

Equipment

- Bead Ruptor Elite (PN 19-040E)
- with
- 2 mL Tube Carriage (PN 19-010-310)
 - 2 mL Hard Tissue Homogenizing Mix (2 mL/2.8 mm ceramic bead kit) (PN 19-628)
- or
- 2 mL Hard Tissue Grinding Mix (2 mL/2.4 mm metal bead kit) (PN 19-620)
- or
- 7 mL Tube Carriage (PN 19-345-007)
 - 7 mL Hard Tissue Homogenizing Mix (7 mL/2.8 mm ceramic bead kit) (PN 19-678)
- or
- 7 mL Hard Tissue Grinding Mix (7 mL/2.4 mm metal bead kit) (PN 19-670)
- and
- Optional Bead Ruptor Cryo Cooling Unit (PN 19-8005)

Procedure

Various animal species hair samples were milled using the Bead Ruptor Elite with 2 mL and 7 mL tube carriages. Both inert ceramic bead media and stainless-steel bead media were used in these protocol optimizations. Only dry grinding protocols are described below in Table 1. Wet grinding may also be a useful sample preparation method. Sample washing was not conducted in these studies, but can be done by rinsing hair samples with isopropanol and drying prior to homogenization.



Bead Ruptor Elite

Sample Type	Method	Diluent & Volume	Bead Kit	Speed (m/s)	Time (sec)	Cycles	Dwell Time (sec)
Bull Hair, 50 mg	Dry Grinding	None	PN 19-620	6.95	50	2	15
Coyote Hair, 3 mm pieces	Dry Grinding	None	PN 19-628	6.8	50	4	15
Horse Hair, 100 mg	Dry Grinding	None	PN 19-678	5.0 *Bead Ruptor 12	30	5	30
Horse Hair, 100 mg	Dry Grinding	None	PN 19-670	6.80 *Bead Ruptor Elite	50	3	180

Table 1: Sample Homogenization Summary



Figure 1: Image of sample before and after homogenization

Discussion

Hair samples ranging from 50-200 mg were processed into a fine powder using the Bead Ruptor Elite with ceramic and stainless-steel bead kits. High bead speeds are required to apply enough force to pulverize the fine, brittle hair sample matrix. Dwell times were used to control sample temperature. Various steroid hormone, drug metabolite, and DNA fragments have been extracted and analysed and proved stable using these protocols. A Cryo Cooling Unit (PN 19-8005) may be added to the procedure to further reduce sample temperature during the dry grinding process.

The Bead Ruptor Elite can be used to semi-automate the hair grinding process. Dwell times (pauses) can be automated, allowing laboratorians to perform other sample prep tasks during the homogenization process. Sample throughput is increased compared to traditional grinding methods where up to 24 samples can be pulverized in as little as two minutes.

To process hair in your laboratory, contact OMNI today.

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