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IMPACT OF FAT COATING PROCEDURE ON POWDER PALATANT AVAILABILITY AND PERFORMANCE IN CATS

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By Élodie Revéret, R&D Project Manager & Loïc Bramoullé, Application Developement - Technical Support

INTRODUCTION

Fat coating plays multiple roles in dry pet food manufacturing, one of them being to stick the powder palatability enhancer on the kibble. This key step is particularly important in feline diets, as cats are very sensitive to palatability enhancer dose variation and coating heterogeneity.

A wide range of coating procedures and fat levels is used within pet food plants. Topical fat doses can vary depending on the diet nutritional target, the core kibble characteristics and the industrial constraints. When a large amount of fat is coated (> 8%), there is a risk of powder embedding into the fat. In this case, palatability might be reduced due to lower powder availability. If atmospheric coating is the most common method used, alternative procedures such as vacuum coating could be interesting to ensure an optimal application.

The goal of this study was to evaluate the effect of several fat coating procedures on powder coating quality and palatability in dry cat food. Vacuum and differential cooling coating procedures were compared to atmospheric coating; innovative methods allowing measurement of powder location and availability on the kibble were used to evaluate coating efficiency. These physico-chemical analyses were completed with sensory trials conducted in cat expert panels.

FOUR FAT COATING PROCEDURES COMPARED

Premium cat kibbles were coated with three different levels of poultry fat - 8%, 11% or 14% - and 2% super premium powder palatability enhancer (powder PE).

Four coating procedures were used for fat application: atmospheric, medium vacuum, high vacuum and differential cooling (Table 1). Powder was then applied at atmospheric pressure.

All the coatings were carried out at room temperature, with poultry fat at 60°C, and using a batch coater *Forberg F120* equipped to work under vacuum.

Table 1: presentation of the four coating methods

Coating procedure	Code	Fat Coating	Powder coating
Atmospheric	ATM	Atmospheric	just after fat
Medium vacuum	MVAC	Vacuum 600 mbar	just after fat
High vacuum	HVAC	Vacuum 300 mbar	just after fat
Differential cooling	DIFF	Atmospheric	24h after fat

After the coatings, the twelve resulting diets were kept at ambient temperature for about one month to allow the system to equilibrate. They were then analyzed and assessed for palatability.

> TWO COMPLEMENTARY METHODS TO MEASURE POWDER AVAILABILITY

Two different methods were used to quantify the powder on the kibbles (Figure 1).

Comprehensive method

For each diet, a whole set of kibbles was ground and a specific endogenous tracer from the powder was measured to evaluate the total amount of powder coated. Uncoated kibbles were also analyzed to check the absence of this tracer. This method allows quantifying the total amount of powder.

Surface method

Forty eight kibbles from each diet were also analyzed using an internal proprietary method developed by DIANA Pet Food application experts (*Aplicalis*). Each individual kibble was put in presence of a reactant that formed a colored complex with a specific endogenous tracer from the powder. The absorbance of the resulting solution was then read with a spectrophotometer and linked to the powder PE concentration using a calibration curve. Uncoated kibbles were also analyzed as a blank.

This surface method allows measurement of the powder amount that is available to the reactant on the kibble surface. The results can be hypothesized as an indication of the amount of powder accessible to the cat's tongue when eating the kibbles.
Analyses of variance were then carried out to assess the effects of the coating procedure, the level of topical fat and their interaction, on the powder availability at the surface.

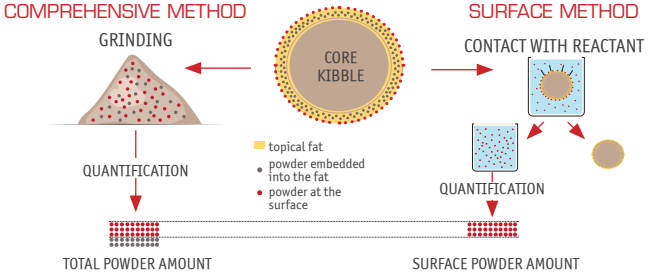

Figure 1: Principles of the two powder quantification methods (comprehensive and surface methods)

> PALATABILITY ASSESSMENT IN EXPERT CAT PANELS

Palatability of the diets was measured at Panelis, DIANA Pet Food expert center in palatability measurement, by an expert panel of 40 cats, using two-day, two-bowl tests. Individual consumption ratios were calculated and preferences were assessed using a Student test.

For each level of topical fat, diets made using medium vacuum, high vacuum and differential cooling were tested versus diets made using the atmospheric coating procedure, so as to assess the potential palatability benefit of these alternative methods.

RESULTS

> TOTAL AMOUNT OF POWDER COATED IS SIMILAR WHATEVER THE COATING PROCEDURE

As seen in Figure 2, all diets had similar total amounts of powder coated whatever the topical fat level and the coating procedure used. The four methods show equivalent abilities to stick powder.

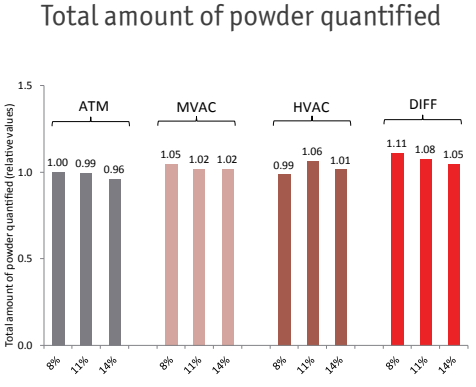

Figure 2: Total amount of powder quantified according to coating procedure and fat level

(Relative values, compared to the diet with 8% topical fat and atmospheric coating)

> POWDER AVAILABILITY AT THE SURFACE DEPENDS ON THE TOPICAL FAT LEVEL

The topical fat level was found to have a significant effect (p<.0001) on the amount of powder measured on the kibble surface.

As shown on Figure 3, powder was generally less available at the surface when increasing topical fat level, probably due to a higher amount of powder embedding by the fat.

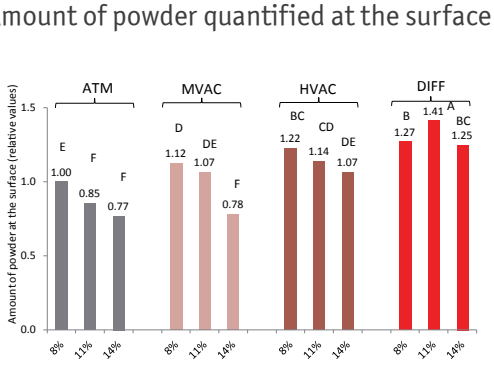

Figure 3: Amount of powder quantified at the surface of each diet

(Relative values, compared to the diet with 8% topical fat and atmospheric coating)

Statistical paired comparisons showed that in atmospheric coating conditions powder was less available with 11% or 14% topical fat than with 8% topical fat. With this coating procedure often used in pet food plants, the more fat coated the more powder embedding.

> POWDER IS MORE AVAILABLE WITH VACUUM OR DIFFERENTIAL COOLING PROCEDURES THAN WITH ATMOSPHERIC COATING

Figure 3 also shows that the coating procedure hads a significant effect (p<.0001) on the percent of powder measured out at the kibble surface. Powder was more available with differential cooling, high vacuum and medium vacuum coating than with atmospheric coating procedure.

Indeed, these alternative methods enable to prevent fat from covering up powder, by pushing it into the kibble or by ensuring it's in solid state when powder is coated. Both differential cooling and high vacuum coating allowed a significant increase of powder availability compared to atmospheric coating whatever the percentage of topical fat. However, paired comparisons showed that with 14% topical fat, medium vacuum was not sufficient to make a difference versus the atmospheric coating procedure; a high level of vacuum was required to force fat into the kibble and reduce powder embedding.

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> PALATABILITY IS IMPROVED WITH VACUUM OR DIFFERENTIAL COOLING

Figure 4 shows that, whatever the fat rate used, differential cooling coating significantly improved palatability compared to atmospheric coating. We can hypothesize that the twenty-four hour time after fat coating allowed the fat to reach its solid state before powder coating. When added, powder palatability enhancer remained at the surface of the kibble, being more available to the cat's tongue thus increasing palatability performance.

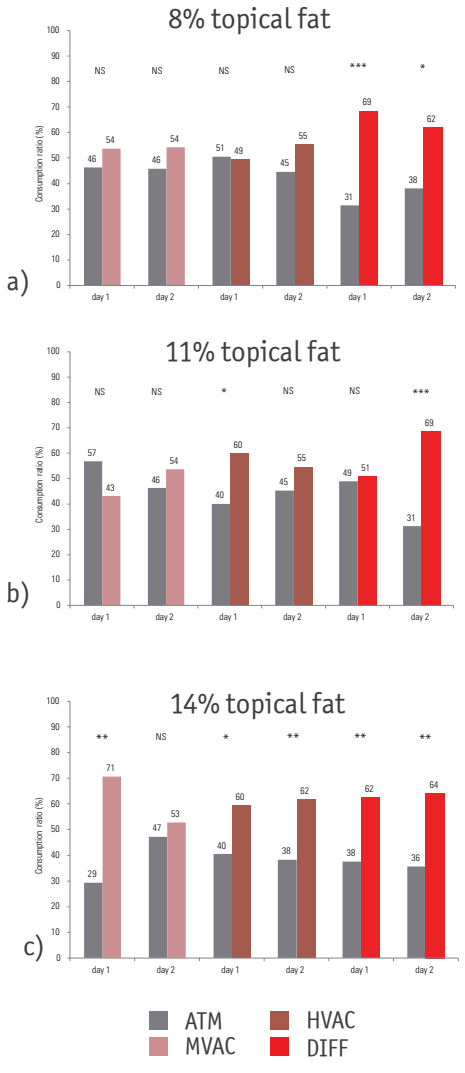

Figure 4: Palatability assessment of the diets made with different coating procedures and 8% fat (a), 11% fat (b) or 14% fat (c)

Thanks to its positive impact on powder availability at the surface of the kibble, the use of vacuum coating also tended to improve palatability performance versus atmospheric procedure. This effect was more pronounced with high vacuum and higher levels of topical fat. Indeed, the more topical fat, the higher vacuum needed to push fat into the kibble to avoid powder embedding and restore palatability.

CONCLUSIONS AND PERSPECTIVES

Understanding pet food palatability drivers requires a systemic approach. Fat and palatability enhancers coating is a key step impacting pet food performance. In this study, the use of innovative physico-chemical analysis methods allowed measuring accurately the behavior of powder on the kibble surface, depending on the topical fat level and way of application. Thanks to additional use of sensorial evaluations, it was possible to establish a link between the coating procedure, the availability of the powder and the way it delivers palatability performance to cats.

Results demonstrated that with an atmospheric coating procedure, the increase of the topical fat level reduces the powder availability due to embedding. Nevertheless, the use of alternative coating procedures such as vacuum coating or differential cooling were shown to be a high potential lever to improve the palatability of cat diets with high topical fat levels.

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