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Physicochemical analysis of honey samples produced in Paraíba (Brazil)

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Received: / Accepted: / Published:

Abstract: The National Agency of Sanitary Vigilance (Anvisa) defines honey as being the natural product produced by bees from flower nectar and/or saccharin exudates of plants. The chemical composition of honey includes sugars, vitamins, minerals, and compounds from secondary metabolism, such as terpenoids and phenolics. The nutritional and medicinal potential of honey make it widely appreciated and commercially exploited. According to Anvisa, the addition of any substance to honey is prohibited, turning the honey into an adulterated product. Thus, the physicochemical analysis is required to ensure the quality of the product. In the present study, five commercial honey samples produced in the Brejo region of Paraíba (Brazil) were analyzed in order to verify possible adulteration or handling problems during product storage or transportation. The Fiehe reaction was performed in order to verify the presence of substances produced by overheating. Lugol reaction was carried out to investigate addition of starch and dextrans, and Lund reaction was performed to verify the level of albuminoid or precipitable substances. Among the samples analyzed, samples II and V showed a positive result in the reaction of Fiehe, indicating the presence of hydroxymethylfurfural, resulting from the degradation of sugars in acidic conditions, mainly when the honey is heated, which can occur during transport or storage. Sample V also presented evidences of adulteration in the Lund and Lugol reactions. Unadulterated honeys promoted the formation of precipitates during the Lund reaction. In sample V the absence of precipitate was observed, which indicates an adulteration/dilution. Sample V also showed evidence of starch addition in the Lugol reaction. The results indicated adulteration in sample V analyzed and heating problems in sample II. The present work emphasizes

the continuous need of physicochemical evaluation to guarantee the quality of these commercial products.

Keywords: Honey, physicochemical analysis, quality control

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1. Introduction

The National Agency of Sanitary Vigilance (ANVISA) defines honey as being the natural product produced by bees from flower nectar and/or saccharin exudates of plants. It is produced by sap-sucking insects or by bees that collected vegetable secretions transform, store and mature the final product in honeycombs. Despite being mostly consumed as food and first source of sugar used by man, it has been used since ancient Egypt for medicinal purposes, participating in 500 of the 900 remedies of that time (MOURA, 2010; REZENDE, 2015).

Currently, the use of honey has increased because of its both medicinal and nutritional properties. Honey chemical analysis clearly demonstrates the nutritional richness of its composition, which includes sugars, micronutrients such as vitamins and minerals, and compounds of secondary metabolism such as terpenes and phenolics (ABADIO FINCO et al., 2010).

According to ANVISA (Resolution - nº 12, of 1978) it is forbidden to add any type of product or substance to honey, therefore it must contain just substances of its original composition.

In order to verify possible adulterations or problems during the honey management, such as overheating, honey samples produced in Paraíba were analyzed following the methodology recommended by Analytical Rules of Instituto Adolfo Lutz (BERA & ALMEIDA-MURADIAN, 2007).

2. Results and Discussion

In order to analyze the quality of honey samples it has been carried out three reactions recommended by the Instituto Adolfo Lutz (2008). The obtained results are presented at Table 1.

Table 1. Result of honey samples analyzed.

Samples	Lund Reaction	Fiehe Reaction	Lugol Reaction
IAL, 2008*	Positive	Negative	Negative
I	Positive	Negative	Negative
II	Positive	Positive	Negative
III	Positive	Negative	Negative
IV	Positive	Negative	Negative
V	Negative	Positive	Positive

*expected results for unadulterated honeys

The first experiment was the Lund reaction that consists in the precipitation of proteic substances from honey. For pure honey,

the precipitate volume should be found in a range from 0,6 mL to 3 mL. It can be observed in Table 1 that the sample V presented negative result for the Lund reaction, indicating possible loss of protein substances during the processing of the product or addition of water or another diluter. The found result may indicate poor quality or a diluted honey (BERA & ALMEIDA-MURADIAN, 2007; ANTONIO & TIECHER, 2015).

For the reaction of Fiehe, a positive result was found for samples II and V, indicating the presence of hydroxymethylfurfural (HMF), a substance produced from the reaction of sugars in an acid medium. The HMF level may rise due overheating or storage for inadequate time and conditions. The higher HMF content in honey indicates lower nutritional quality, because under those drastic conditions, sugars, enzymes and vitamins are destroyed (BERA & ALMEIDA-

3. Materials and Methods

For this study five samples of honeys produced in Paraíba's region of Brejo were analyzed. The experiments were carried out at the Organic Chemistry and Biochemical Laboratory of Chemistry and Physics Department of Universidade Federal da Paraíba Campus II, at Areia-PB.

4. Conclusions

The results indicated adulteration in one sample analyzed and heating problems in another sample. The present work emphasizes the need of keeping the quality in every step from

MURADIAN, 2007; ANTONIO & TIECHER, 2015).

In the determination of the Lugol reaction, sample V showed a positive result, indicating that the product was probably adulterated with starch. Fraud can be observed when the final color is violet or blue. The color intensity exhibited by the compound after addition of the Lugol solution will vary according to the amount and type of polysaccharides added in the honey. The starch is often used as thickener in samples that were previously diluted with water (BERA & ALMEIDA-MURADIAN, 2007; ANTONIO & TIECHER, 2015). The starch is often used as thickener in samples that were previously diluted with water. In our experiments, the results found for sample V indicates that it may be adulterated by dilution and addition of starch (ABADIO FINCO et al., 2010).

The reactions of Lund, Fiehe and Lugol were carried out following the recommended methodology of the Analytical Rules of Instituto Adolfo Lutz (2008). All experiments were carried out in triplicate.

producing to commercializing the honey. Simple physical-chemical analyses were demonstrated to be very useful in detecting adulteration of honeys, guaranteeing the quality of these products.

Acknowledgments

UFPB, CAPES and CNPq.

Author Contributions

Authors 1, 2 and 3 carried out the experiments; Authors 4, 5 and 6 supervised the research.

Conflicts of Interest

There are no conflicts of interest.

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