

EFFECT OF GAMMA RADIATION IN MULTIFLORAL HONEY



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INTRODUCCION

- Multifloral honey is made by various species from different flowers nectar and is used as food by consumers, or even for exportation
- These honeys are appreciated in Brazil and in other countries as sweet substances produced by bees
- Its consumption has been increased and it has being also used as raw material for the food industry

INTRODUCION

- Honey must be a safe food, so there is a need of a quality and processing control.
- In order to low the level of microbiological contamination it was used the process of irradiation
- MIGDAL *et al.* (2000) applied the irradiation in honey using a dose of 10 kGy and they verified an effective reduction in the microbial load, without any significant alteration in the physicochemical characteristics.

OBJECTIVE

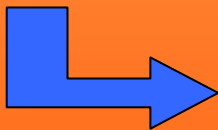
The aim of this work is to verify if there are any physicochemical modification in honey submitted to five different irradiation doses (5, 10, 15, 20 and 25 kGy).

MATERIAL

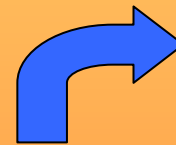
Samples were collected directly from the bee hives and processed using beekeepers techniques



desoperculation



centrifugation



decantation



filling

MATERIAL

Apiary




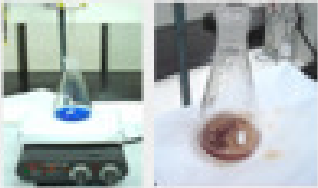




METHODS

- A source of ^{60}Co , was used (Gammacell 220 AECL – Atomic Energy of Canadá Ltd), located in Radiation Technology Center – IPEN - CNEN/SP.
- The irradiations process were applied in packaged honey on glass pot with metallic cork at room temperature.
- This technique was performed according with the Brazilian Food Regulation: Resolution Technical – RDC N^o 21 (BRASIL, 2001a).

Irradiation method




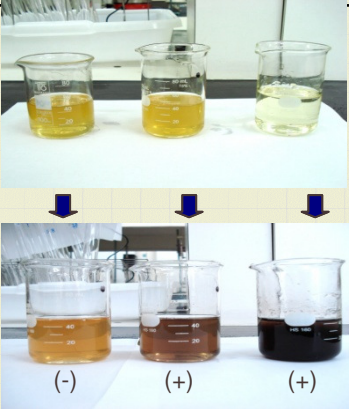

METHODS

Physico chemical parameter	Reference	Picture/ methodology
Moisture Refratometric method	BRASIL, 2000; AOAC (item 969.38b)	
Reducing Sugar and Apparent sucrose Fehling titrimetic method	BRASIL, 2000; CAC- 1989 item 7.1 e 7.2 e BOGDANOV, 1997	
Acidity Titrimetic method	BRASIL, 2000 e AOAC, 1990, item 962.19	
Hydroxymethylfurfural and Diastase Spectrophotometric method	BRASIL, 2000; CAC- 1989 item 7.4	
Insoluble solids Gravimetric method	BRASIL, 2000; CAC- 1989 item 7.7	
Minerals/ Ashes Gravimetric method	BRASIL, 2000; CAC- 1989 item 7.5	

Physicochemical Methods

<p>pH</p>	<p>IAL, 2005</p>	
<p>Color mmPfund</p>	<p>BRASIL, 1981</p>	

Qualitative Methods

Paramether	Reference	Photo
Fiehe Detection of HMF	IAL, 2005	 A photograph showing a test tube rack with four test tubes. The first tube on the left contains a red liquid, the second a pink liquid, and the other two are clear.
Lugol Presence of glucose	IAL, 2005	 A photograph showing two rows of three beakers each. The top row shows three beakers with yellow liquid. The bottom row shows three beakers with darkening liquids, labeled (-), (+), and (+) from left to right. Blue arrows point from the top row to the bottom row.
Lund Natural precipitation of honey proteins	IAL, 2005	 A photograph showing five test tubes in a rack. Each tube contains a yellow liquid with a white precipitate at the bottom.

RESULTS

Table 1: Results of physicochemical analysis of honey samples submitted to 0-25kGy

Analysis kGy	0	5	10	15	20	25
Moisture %	17.0	17.0	16.60	16.60	16.20	16.20
Brix %	81.0	81.0	81.40	81.40	81.60	81.60
HMF mg/Kg	12.18 ± 0.01 a	11.27 ± 0.06 ab	9.92 ± 0.01 bc	9.52 ± 0.03 c	7.98 ± 0.06 d	8.03 ± 0.06 d
Mineral Content %	0.26 ± 0.00	0.25 ± 0.01	0.25 ± 0.00	0.25 ± 0.00	0.23 ± 0.00	0.23 ± 0.00
Acidity meq/mg	21.32 ± 0.29	21.99 ± 0.50	21.32 ± 0.29	22.16 ± 0.28	22.15 ± 0.29	22.99 ± 0.00
pH	4.23 ± 0.01	4.19 ± 0.01	4.21 ± 0.01	4.19 ± 0.02	4.17 ± 0.01	4.17 ± 0.01

Results mean ± standard deviation

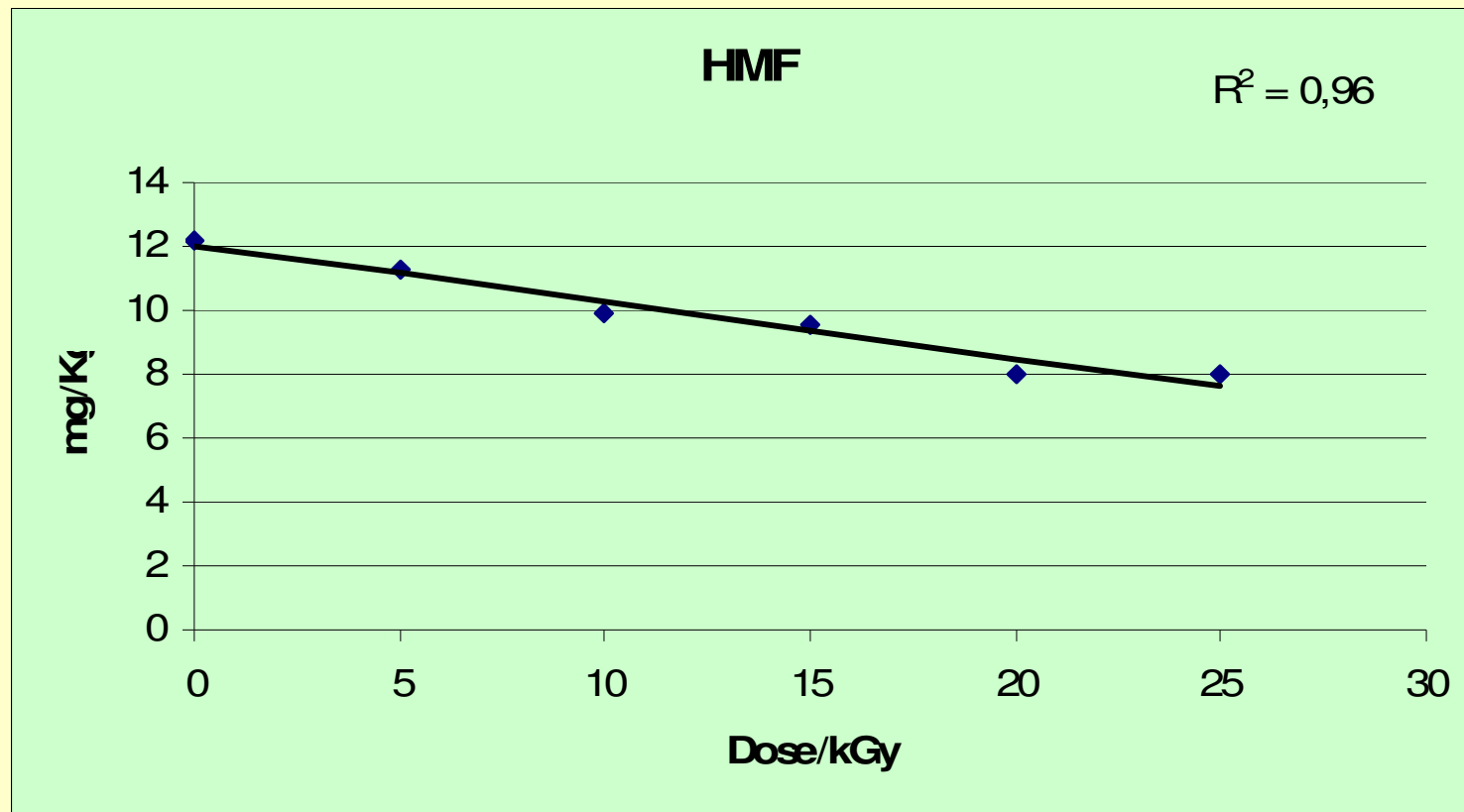
Means with (a - d) are significantly different ($p < 0.05$)

RESULTS

- In the analyzed samples the honey with initial 17% of moisture, had its value reduced to 16.2% (irradiation of 20 and 25kGy (Table 1) but this reduction was not significant.
- High moisture content is responsible for honey fermentation and according to Brazilian regulation it can not be above 20%. Yeasts responsible for fermentation occur naturally in honey and water content of honey is a key factor concerned in spoilage by fermentation.

RESULTS

Gradual Decrease of HMF



Graphic 1

RESULTS

- In accordance with Table 1 and Graphic 1 we can observe that there is a significant alteration from 10 kGy for HMF.
- From all the physicochemical analyses HMF and diastase activity are the most important parameters as indicative of the storage time and/or honey heating.
- In accordance with the honey Brazilian regulation it can not contain more than 60 mg/Kg of HMF.
- Some articles quoted that high amounts of HMF can become toxic.

RESULTS

Table 2: Results of physicochemical analysis of honey samples from 0 - 25kGy

Analysis kGy	0	5	10	15	20	25
Reducing Sugars mg/kg	72.31 ±0.60	69.41 ± 1.24	68.97 ± 0.39	73.98 ± 1.07	72.96 ± 0.65	71.46 ± 0.70
Apparent Sucrose mg/kg	6.48 ± 0.65	8.19 ± 2.57	5.31 ± 2.70	4.86 ± 1.35	4.95 ± 0.33	5.64 ± 1.26
Insoluble solids %	0.02 ± 0.00	0.02 ±0.00	0.01 ±0.00	0.01 ± 0.00	0.01 ± 0.00	0.01 ± 0.00
Diastase activity DN	6.22 ± 0.25	7.44 ± 0.05	4.36 ± 0.11	5.53 ± 0.15	5.66 ± 0.03	5.06 ± 0.20

mean ± standard deviation

DN= diastase number

RESULTS

- **The results obtained for the sugars are in accordance with the Brazilian regulation and they did not present significant alteration with the irradiation process.**
- **The same behavior occurred with the results of all other parameters like ashes (minerals), insoluble solids and free acidity.**

RESULTS

- Diastase activity is also an indicative of honey pureness, and the results obtained are in accordance with Brazilian regulation (minimum of 3 DN when HMF < 15 mg/Kg).
- Diastase activity is expressed as mL of 1% starch solution hydrolyzed by the enzyme in 1g of honey, during 1 hour.

RESULTS

Table 3: Results of physicochemical analysis of honey samples from 0 at 25kGy

Analysis kGy	0	5	10	15	20	25
a_w	0.56 ± 0.00	0.56 ± 0.00	0.56 ± 0.00	0.57 ± 0.00	0.57 ± 0.00	0.56 ± 0.00
Lund	Negative	Negative	Negative	Negative	Negative	Negative
Fiehe	Negative	Negative	Negative	Negative	Negative	Negative
Lugol	Negative	Negative	Negative	Negative	Negative	Negative
Color/ Pfund	Amber 92	Amber 108	Amber 108	Amber 111	Amber 101	Amber 108

mean ± standard deviation

Lund negative (precipitate between 0.6 – 3.0 mL)

Aw = water activity

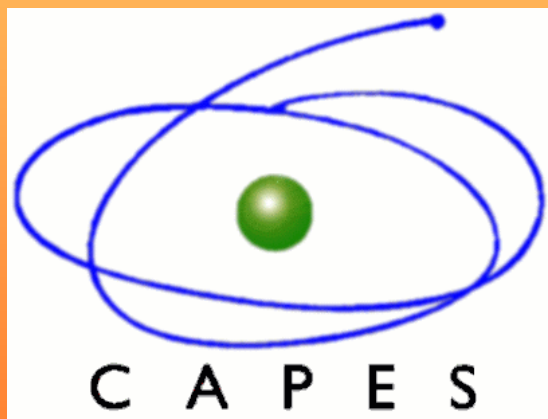
RESULTS

- The tests Lund, Fiehe and Lugol are done in order to indicate honey adulteration. All the three tests showed that this honey was not adulterated and that with the irradiation, the results does not change.
- The water activity (a_w) can be a parameter which controls microbial growth. The limiting water activity for growth of osmotolerant yeasts (naturally found in honey) is about 0.61 till 0.76.
- According to table 3 when gamma radiation doses were applied, although modified Pfund scale values, have not changed the honey color (Amber).

CONCLUSIONS

- The only parameter which shows any modification was HMF when honey was submitted to five different irradiation doses.
- This study showed that ideal dose of gamma radiation to be applied in multifloral honey is 10 kGy.
- Gamma radiation with 10 kGy or more can decrease HMF content.

ACKNOWLEDGEMENTS



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