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Full Length Research Paper

Physical properties of honey products in Algeria

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Honey is considered as the sweetened natural substance produced by mellifluous bees from the flowers nectar, plants parts or the insects excretions generally left on the same parts. Although Algeria possesses floral and climatic potentialities; it remains a small honey producer. Among analyzed samples,74% correspond to codex standards .This latter may increase if certain measures such as a national regulation including standards for Algerian honey, a referential beekeeping and hive products laboratory are implemented. A labeling system followed by a guide for a good practice of beekeeping and production should be implemented as well.

Key words: Honey, physicochemical analysis, quality, Algeria.

INTRODUCTION

In the Algerian collective consciousness, it is evident that honey produced in our country follows the common rule: The honey quality justifies the price. Indeed, this noble and food scarce, remains expensive and reserved for patients and special occasions. Yet, in absence of specific national rules in this matter "quality" remains theoretical and poorly studied.

Algerians beekeepers who have always sought to preserve and protect the natural qualities of honey hope to find other markets than the local ones to sell their surplus production. However, to achieve this aim, they must first comply with the conventional guidelines and regulations. Great quantities of honey of doubtful quality proposed on the market means that the consumer is often misled. The absence of national regulation, insufficient quality control laboratory and the lack of a professional organization make the honey industry unstructured.

The purpose of the present study is to evaluate the quality of Algerian honey and verify its compliance with the standards of codex. Eight parameters were selected: water content, rate of hydroxy-methyl furfural (HMF), free acidity, pH, electrical conductivity, color, falsification search and detecting residues of antibiotics.

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MATERIALS AND METHODS

Sampling

50 honey samples were collected randomly from beekeepers of trade fairs in the central region of Algeria between 2009 and 2010. Each sample weighed 250 g and clearly identified by date of harvest, and floral (Figure 1) and geographical origin (Figure 2).

Technical analysis

In our study the physical and chemical parameters were studied using the methods harmonized by European Commission Directive /110/CE (2001): water content (index of refraction), electrical conductivity (conductometer), pH and free acidity, the HMF (White method), color (Pfund - Lovibond), falsification of research (Fiehe reaction) and the search for antibiotics: chloramphenicol, streptomycin and oxytetracycline by HPLC (Shimadzu LC/10AVP type).

RESULTS

Out of the 50 samples analyzed, 48 were compliant to the codex standard (96%) with an average of 17.38. It is worth mentioning that 36% of honey collected has moisture content between 17 and 17.5% (Figure 3) which make these honeys safe from fermentation (Prost, 2005). Table 1 presents the results of physicochemical analysis obtained by comparison with the limits of the codex (Codex standard 12-19811).

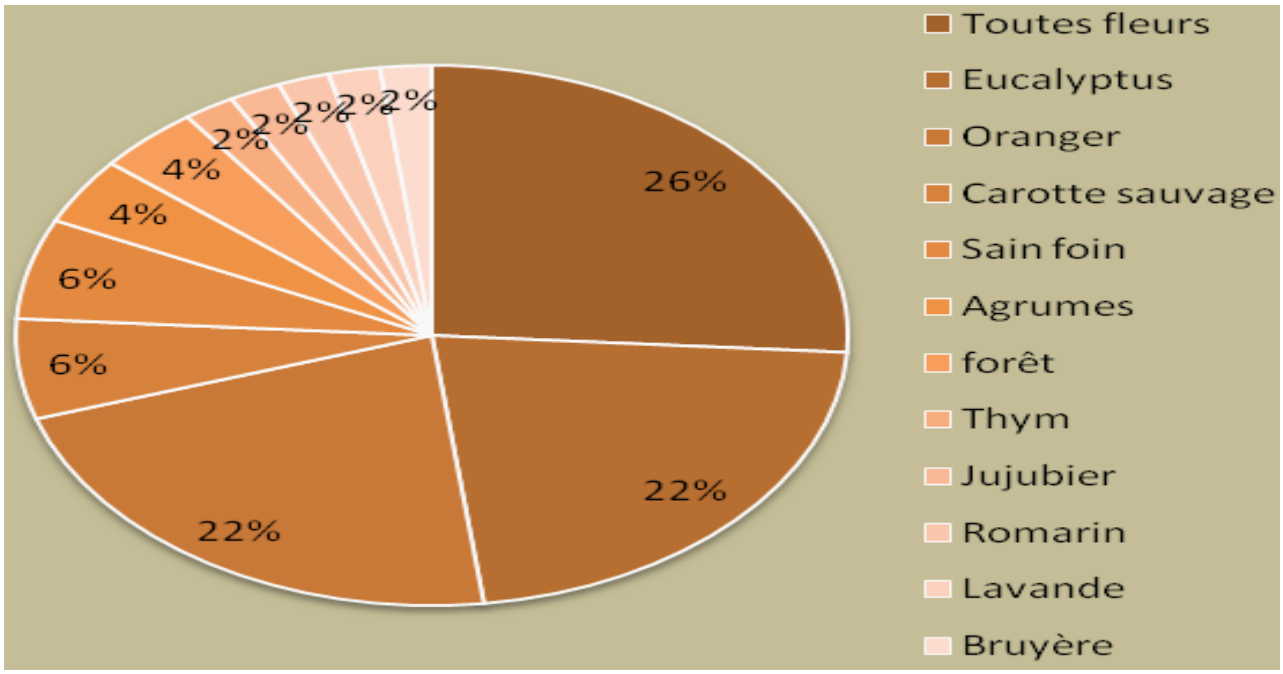


Figure 1. Distribution of samples of honey by floral source.

Figure 2. Regional origin of 50 samples of honey.

One sample n° 42 Heather floral origin of the Wilaya of Tizi Ouzou (or 02%) has an electrical conductivity of 0.82 mS/cm. The origin of this honey is presumed from heather, therefore normally characterized by high electrical conductivity and therefore considered by the codex standards. Since other samples have electrical conductivity less than 0.8 mS/cm, we concluded that all our samples are nectar honeys (Figure4) (Makhloufi, 2007).

43 samples (86%) correspond to the codex standard (≤ 50 meq/kg), 14% samples have a high acidity probably a sign of fermentation. These honeys might have lost some

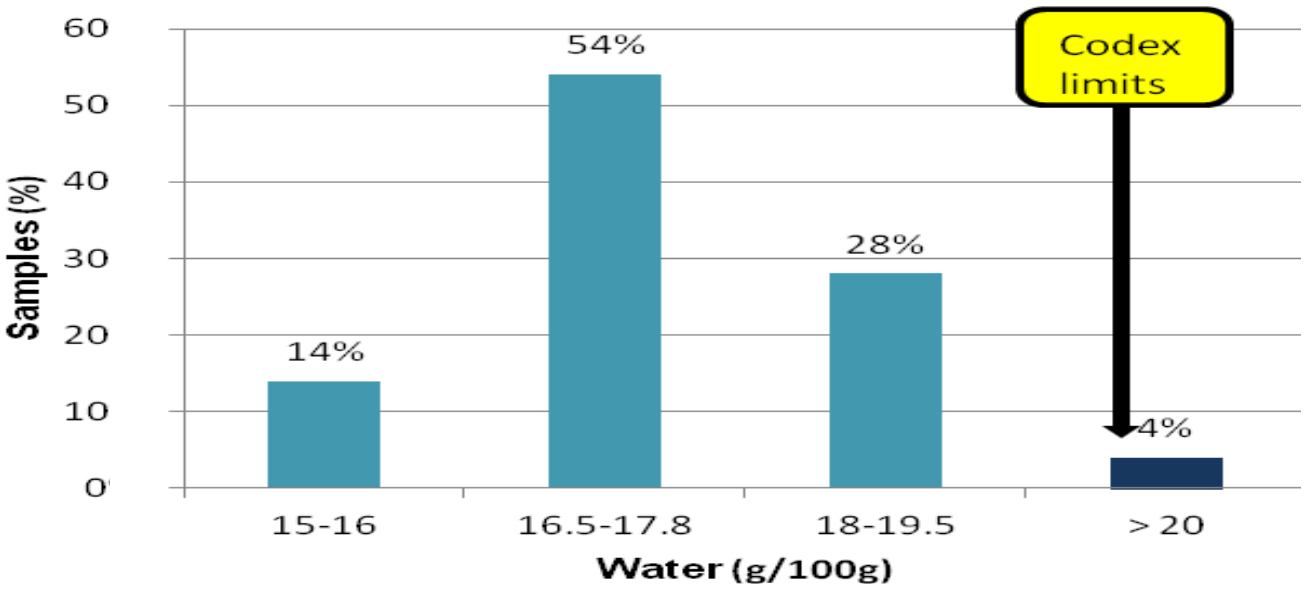


Figure 3. Distribution of samples according to values of water content.

Table 1. Results of physicochemical analysis of 50 samples.

Parameter	Average value ± standard deviation (écart-type)	Minimum and maximum value	Limits of international standards (codex)	Number of samples exceeding international standards
Water content (%)	17.38 ± 1.26	15 – 21	< 20 %	2 samples
Electrical conductivity (mS/cm)	3.63 ±1.83	1.1 – 8.21	Honey nectar ≤0.8 mS/cm Honey dew ≥0.8 mS/cm	0
pH	3.74 ±0.38	2.97 – 5.35	No limits	
Free acidity (meq/kg)	37.41±15.00	13 – 66	50 meq/kg	7 samples
HMF (mg/kg)	37.80 ±111.69	0 – 598.8	<40 mg/kg	6 samples
Coloring (mm Pfund)	62.7 ±27	11– 119	No limits	
Search falsification		Positive reaction : 36.66 %		Negative reaction : 63.34%
Search antibiotiques residues		No residues of oxytetracycline No residues of chloramphenicol No residues of streptomycin		

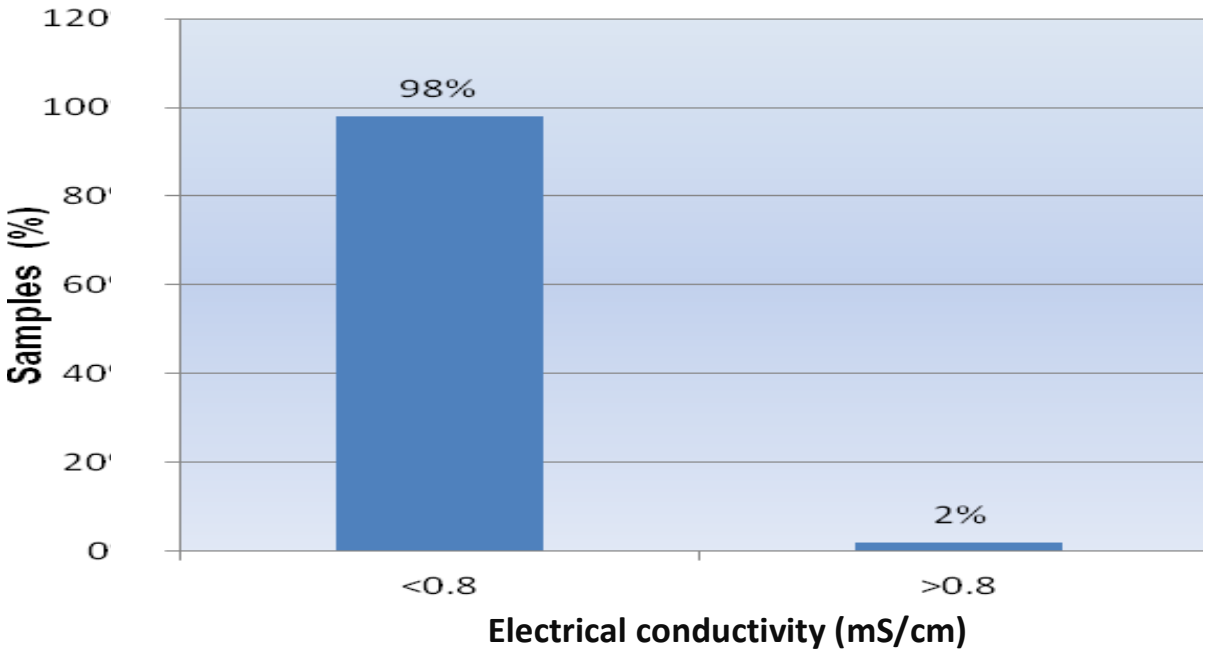


Figure 4. Distribution of honey samples according to values electrical conductivity.

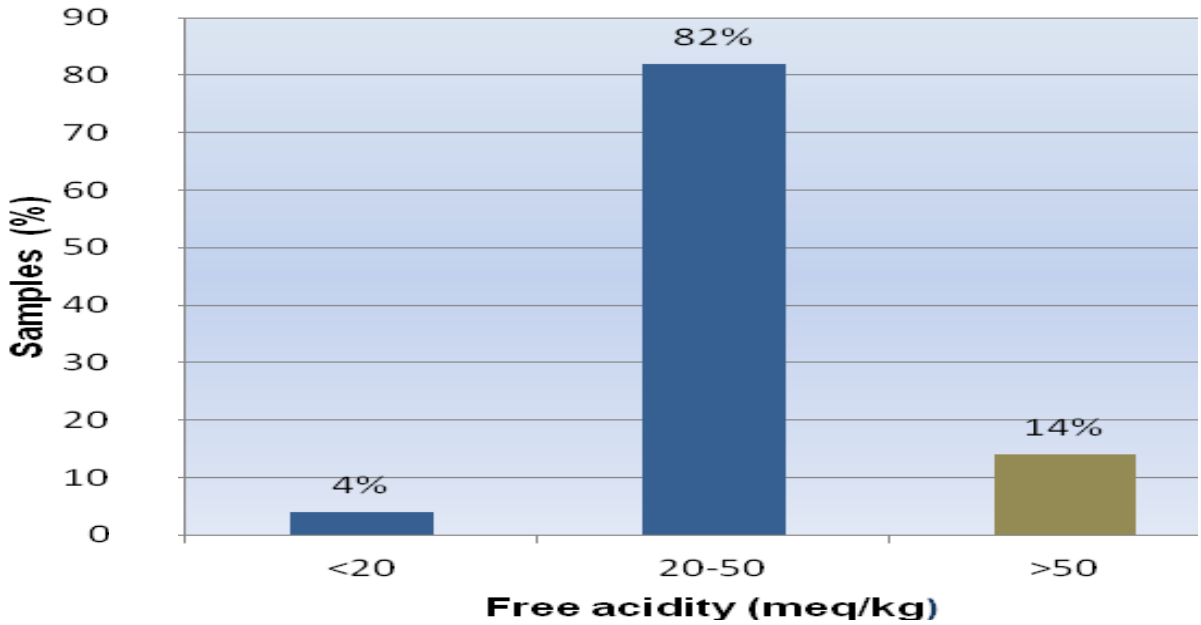


Figure 5. Distribution of samples according to the free acidity.

of their quality. All honeys are acidic, but those with high acidity will deteriorate even more rapidly with particularly adverse consequences on taste and shelf life (Schweitzer, 1998). Two samples (04%) had a rate of acidity below 20 meq/kg. These honeys are coded under numbers 15 (citrus floral origin of the wilaya of Blida) and No. 44 (original orange flower of the wilaya of Blida) both collected between April and May 2010. They do not appear to have undergone fermentation (Figure 5).

The HMF is a quality criterion (Marceau, 1994). The spectrophotometric analysis of our samples revealed that 44 of them (88%) had levels below the limits HMF codex, 8% have a rate of HMF between 40 and 80 mg/kg and 02

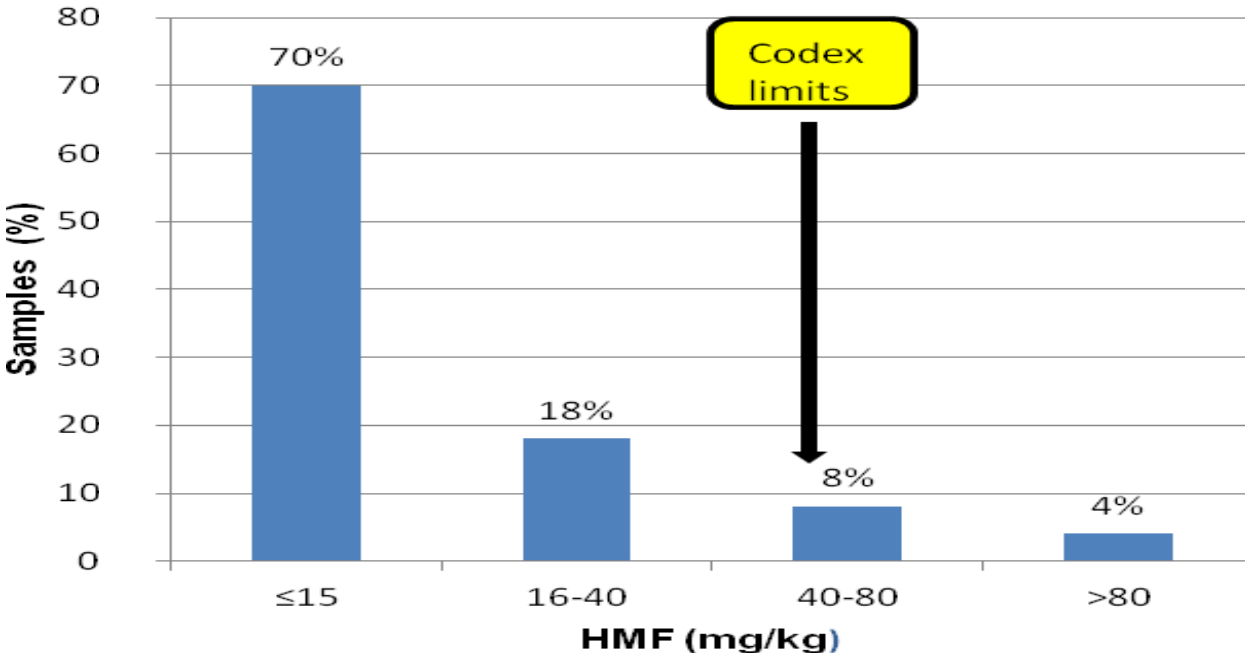


Figure 6. Distribution of samples according to the values of HMF.

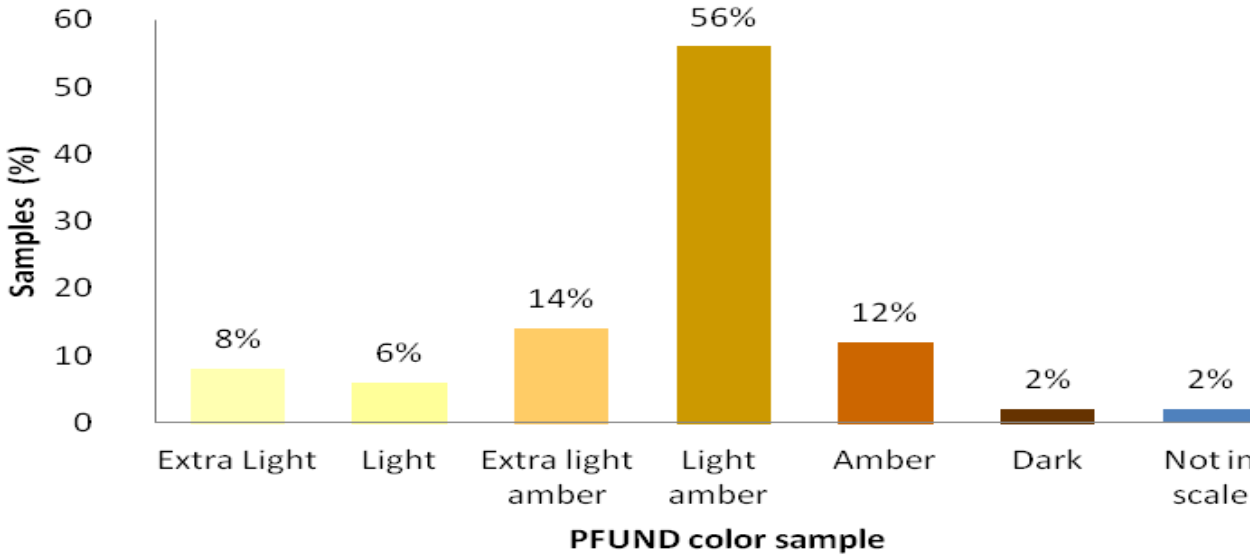


Figure 7. Distribution of samples by staining.

samples are considered of unacceptable quality with very high values of HMF (Figure 6). These values relate to samples n° 3 eucalyptus floral origin of the Wilaya of Tizi Ouzou and n°21 flower honey origin of the Wilaya of Bouira and can be explained by inadequate treatment of these honeys (Hadorn et al., 2003) probably overheating (White, 1964).The average color corresponding to our honey samples is 63 mm Pfund (amber light) with a standard deviation of 27 mm Pfund, or values between 36 and 90 mm Pfund (extra light amber to amber), which on the scale Pfund covers the full range of honey colors (Gonnet, 1982). For the sample No. 3 wide color could not be determined while the sample 42 is 119 (dark) this is probably the result of unsatisfactory conditions of processing or storage (Schweitzer, 2001) (Figure 7). We have had eleven positive reactions from 30 samples submitted to the reaction FIEHE (36.66%) indicating a probable forgery by adding synthetic sugar. This number

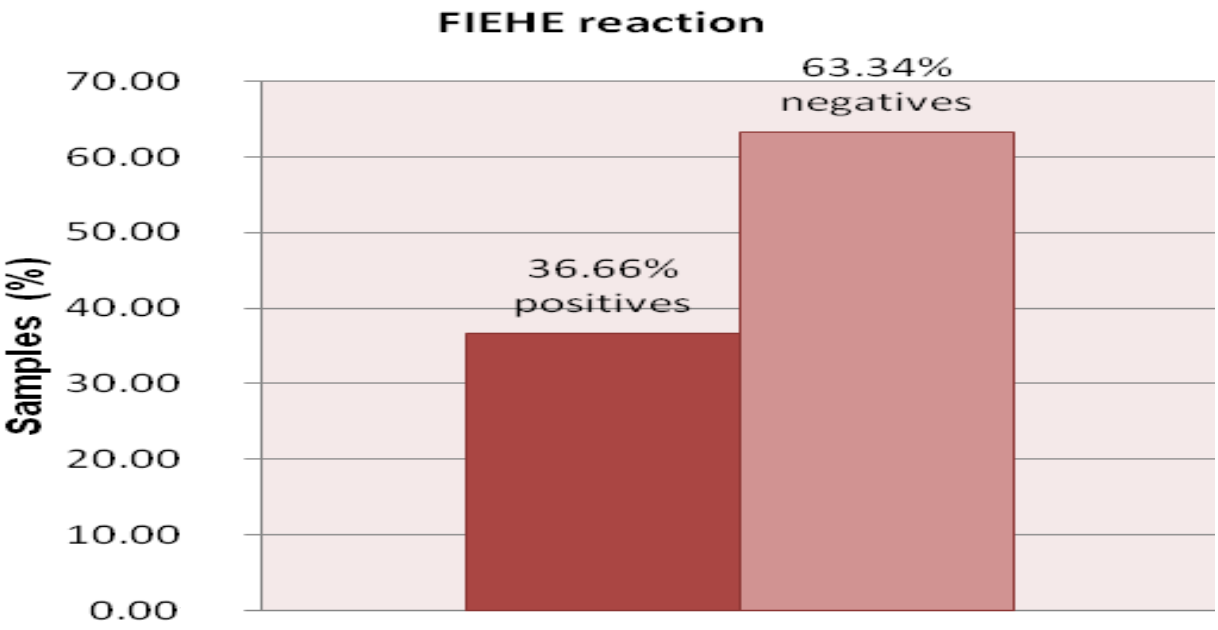


Figure 8. Distribution of samples according to research forgery.

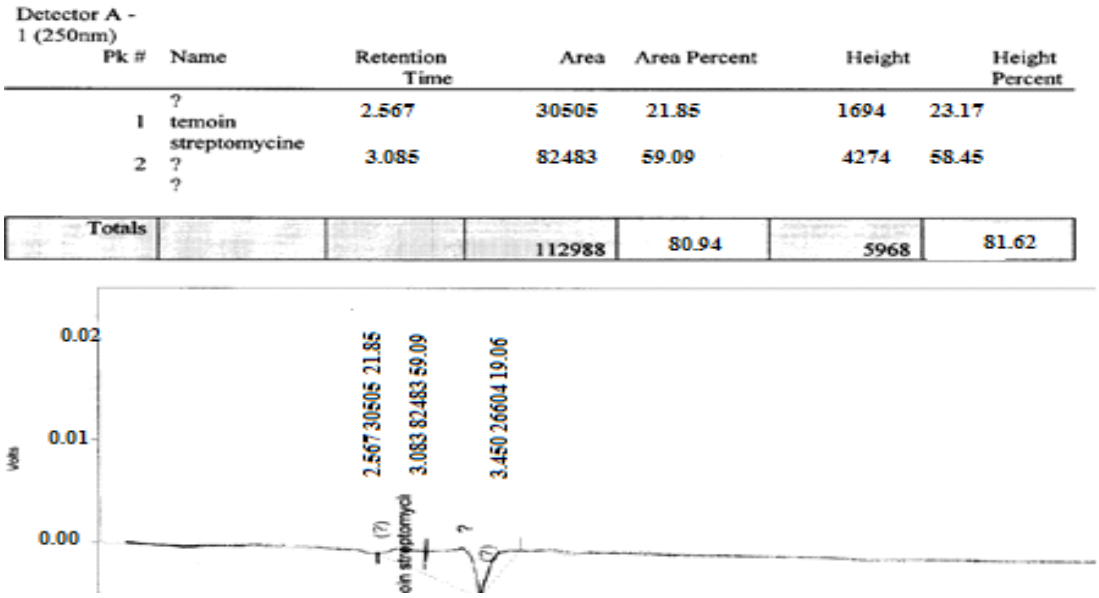


Figure 9. Chromatogram streptomycin.

seems too high as noted by LE COQ (1965). Weak reactions are also obtained with some honey heated as well as unheated. It is important to compare the color obtained with that provided from control sample with negative reaction in which a 2% of sugar is incorporated (Sweitzer, 1998) (Figure 8).

Given the absence of maximum residue limits (MRLs) set for honey; the detection threshold was considered the threshold of positivity: 15 mg/kg for tetracycline and 10 mg/kg for streptomycin (Hirsh, 2002). Zero tolerance is applied to chloramphenicol since it is banned from use in food producing animals in EU since 1990 (Regulation 2377/90/UE). Of the samples analyzed none was positive for antibiotics sought (Figures 9, 10 and 11).

CONCLUSION AND RECOMMENDATIONS

74% of samples analyzed correspond to codex standards (Codex standard 12-19811). In the light of these results

Detector A - 1
(325nm)

Name	Retention Time	Area	Area Percent	Height	Height Percent
temoin	1.783	13288	38.25	21.04	56.90
temoin	2.000	15258	43.92	1016	27.47
Totals		28546	82.16	3120	84.37

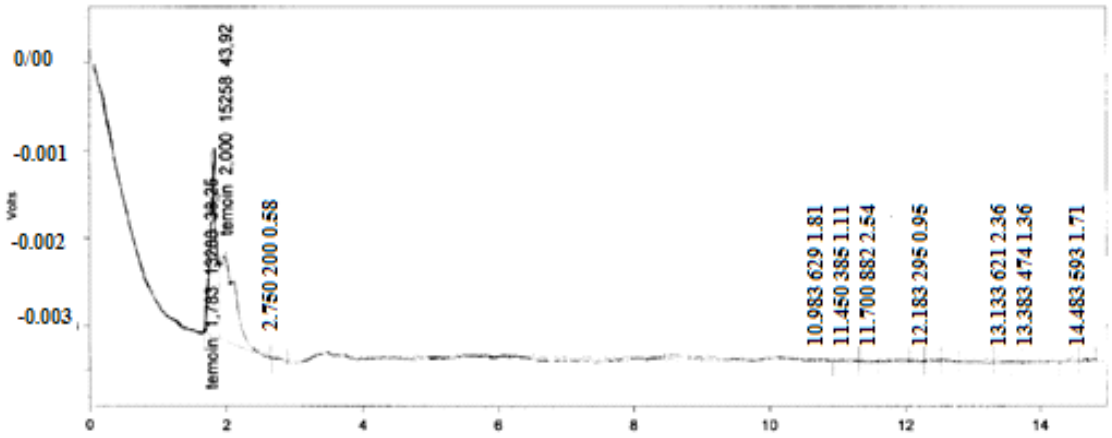
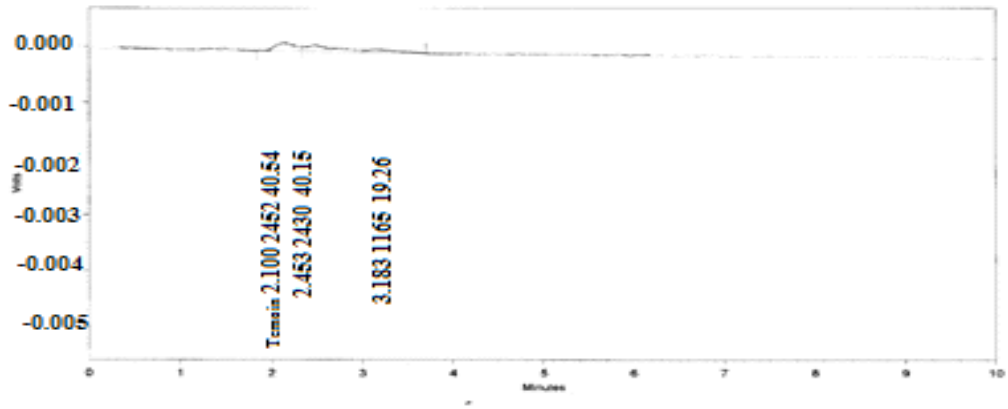


Figure 10. Chromatogram oxytétracycline.



Detector A - 1
(272nm)

Pk #	Name	Retention Time	Area	Area Percent	Height	Height Percent
1	temoin	2.100	2452	40.54	149	47.60
Totals			2452	40.54	149	47.60

Figure 11. Chromatogram chloramphénicol.

these honeys can be exported to foreign countries. 26% of them have one or more defects. The rate free acid (14% of non-compliance) and Hydroxy-Methyl-Furfural (12% of non-compliance), should be subject to more attention from beekeepers looking to improve the quality of their product. We found interesting to compare our results with the standards required in some competitions of honey. In fact this practice is increasingly common especially in Western countries. It has the double benefit of enhancing the product and a mean of advertizing and informing the media about beekeeping and honey. We have taken for example Apimondia 2009 contest held in France, where the requirements of water content should be lower than 2% of the threshold set by European

legislation, that is, <18% and a rate of HMF <15 mg / kg. 60% of our samples meet these criterias and therefore can theoretically enter/participate in/take part of a competition. The economic benefits driven from such advertising can be of great benefit for the honey industry in the region. Antibiotic research conducted by HPLC showed the absence of antibiotics such as streptomycin, oxytetracycline and chloramphenicol.

For detection and quantification of residues of antibiotics, several methods are applied such as HPLC, or the method of Sharm screening test. Some international laboratories are using modern technologies such as the measurement system Biacore new immunochemical technique for optical sensors suitable for organic honey (Gatermann, 2004).

It is obvious that the usefulness of a highly developed beekeeping industry in Algeria is not debatable. Algeria is a country with a traditionally large community of consumers of honey and its production possibilities are very important due to its climate and resources. It is important to mention that the physico-chemical analysis showed that 74% of samples meet the codex standards, while 26% had one or more defects. The rate of free acid (14% of non-compliance) and HMF (12% of non-compliance) are the most important parameters that must be considered by the beekeepers to ensure compliance of honey produced. During the long journey of honey production, some steps are crucial for the quality of the final product. Therefore, beekeepers must comply with the rules of modern beekeeping practices to deliver to the consumer a honey that meets criteria quality. Qualitatively Algerian honey can compete with major producing countries, but this requires an upgrade of the industry incorporating all the food chain, focusing primarily on:

1. Rules in conformity with international standards;
2. Implementation of control laboratories to standardize honey analysis;
3. Training of all actors involved in honey production;
4. Establishment of a professional organization;
5. Improving quality through the labeling of certain products and promoting the export of local products.

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