J. Soil Sci. and Agric. Eng., Mansoura Univ., Vol. 10 (7): 377 –381, 2019

Development and Evaluation of a Honeycomb Uncapping Machine

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ABSTRACT

An uncapping machine was designed and fabricated to uncap both two sides of honeycomb leading to remove the thin wax layer that seals the honey cells. The developed uncapping machine is tested at the Agric. Eng. Res. Inst (2019) under four feeding chain speeds (10, 15, 20 and 25 rpm), four spiral knife speeds (150, 200, 250 and 300 rpm) and four levels of heating temperature for the uncapping device (without heating, 35 , 40 and 45 ^{0}C). The interaction effect between different parameters for the uncapping device resulted in 192 tests. Measurements were taken for the machine productivity, uncapping efficiency and power requirement. The obtained results concluded that the uncapping machine can be operated successfully at the optimum operating parameters of 10 rpm feeding chain speed, 300 rpm spiral knife speed and 40 °C of spiral knife temperature. These operating conditions cause an uncapping efficiency of 95.2 %, productivity of 240 frames / h, consumed specific energy of 8.9×10^{-3} kW.h/frame. The uncapping machine reduced the estimated cost by 3 times than the manual knife uncapping. Therefore, the developed uncapping honeycombs machine is considered an effective solution for precise controlling of uncapping honeycomb invade Egyptian beekeepers and it gives continuous satisfactory uncapping.

INTRODUCTION

In Egypt, there are three main seasons for harvest Honeybee, Citrus season during the first two weeks of April, Clover season from May up to the first week of June, and cotton season during August and September. Egypt exports honey to different countries. Also, Egypt export beekeeping tools and swarms to different Arabian and African countries.

The first step in the extraction process of honeybee is to remove all of the cappings. In Egypt, this process conformed manually using uncapping a hand-held knife. Therefore, a high quality automated uncapper designed and construction working by uncap two sides of honeycomb simultaneously with moving chains using a spiral hot knife auger which make the process easier than doing this task manually. It could be considered suitable for small and big beekeepers with a chine feed for six frames. Honey processing starts with uncapping of the honey combs which consists of the removal of the thin wax layer that seals the honey cells. The wax cappings are sliced off by a sharp long knife or special knives heated by steam or electricity or by capping scratchers (Jeff , 2002).

The disadvantages of using uncapping a hand-held knife for uncap the wax layer are summarized as the following:

1-The knives should be hot (around 45 °C) so as to avoid damaging the cells and frames. If they are too cold, they will tear the cells. Therefore, these knives must be furnished with a keen edge and must stand in boiling water between alternate uses this is a problem for honey due to increase moisture content in pure honey more than 23% lead to honey fermentation (Bogdanov, 2010).

2-Uncapping with a hand-held knife, take a lot of time to rotate the frame to uncap two sides of honeycomb. The cappings can drop into a tray below.

3-Grip the frame with the thumb lying along the end bar and use the knife to cut downward, causes a risk of cutting the labor thumb if the knife slips. It may contaminate the honey.

4-Depressions in the comb that are missed with the knife can be uncapped using a capping scratcher.

Various types of cutting or perforating devices are used in the uncapping operation. These may be operated by hand or mechanically. Some of the large, mechanical uncapping machines with high speed rotating cutters have not heating device on the cutters. Paweena (2004) designed and fabricated uncapping machine to uncap two sides of honeycomb simultaneously using foreign uncapping knife and farmer knife. Test results showed that there were no significant difference appeared among all types of knifes in term of quality. However, it was found that the uncapping machine with electric knifes showed the best result of working capability. This machine could uncap 103 frames/ hr with using electric energy of 0.07kW/hr. Consequently, it could produce 247, 200 frames/year and cost reduction was 62.52 baht as well as payback period was 0.9 year. Hooper (1991) stated that capping is cut off with a sharp, fluted kitchen knife. The fluting on the blade helps to prevent the knife being held by the viscosity of the honey.

Nichols (1988) described how he made a honey knife from two thin sheets of stainless steel (welded together at the edges; between them a heating element (low voltage, high current) encased in insulating material, and inserted in a slot on the thin edge of blade. Heating honey up to 40 °C (104 °F) leads to destruct many of organic material and the most important enzyme diastase (α -and β-amylase). It destroys inverts, and diastase activities (Melnyk, 2002; Oddo *et al.*, 2004; Ruoff and Bogdanov, 2004). At the same time, heating leads to dehydrate sugar (fructose) and accumulate of HMF (Hydroxy methyl furfural) (Yuriy *et al*., 2006; Andreia *at al.*, 2011).

The advantages of using uncapping machines to uncap honeycomb frame are summarized as the following:

1- Never immerse uncapping knife in boiling water.

2-Whatever method you used to remove cappings, cut back to the wood on the top and bottom bars. This keeps the combs an even thickness so they fit back neatly into the supers.

3-Operating temperatures that provide a smooth cut without tearing the cell walls.

4-Mechanical uncapping machines with high speed rotating cutters.

5- Automatic machines have been invented which will cut off the cappings either with whirling knives or with metal parts attached to rollers between which the combs are moved mechanically.

6- Honeycomb is not destroyed and best result of working capability (Paweena, 2004).

The main objective of the present study is to construct and evaluate the performance of a new prototype unit suitable for uncapping both two sides of honeycomb frame simultaneously without destroying the comb to meet the following requirements, reduce the time and cost of uncap honeycomb per frame and improve efficiency of the extraction process.

MATERIALS AND METHODS

To achieve the objective of this research, a new uncapping honeycomb prototype unit was designed, constructed and tested at the Agriculture Engineering Research Institute (AEnRI), Dokki-Giza in 2019. Honeycomb frames were collected from private foreign apiary beehives at Qalubia governorate, Egypt, during April 2019.

1-Honeycomb frame

The uncapping device was designed relative to specification dimensions of honeycomb frame. The outer and inner lengths of the honeycomb frame were 49 and 44 cm with width of 4 cm and thickness of 4 cm from the top and 3 cm from the bottom, respectively**.**

2-Description of the prototype

The uncapping honeycomb prototype consists of five essential parts included uncapping device, power transmission, feeding device, electrical control unit and wax hopper as shown in Figs.1 and 2.

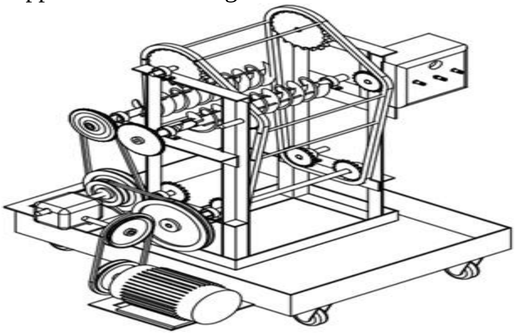

Fig. 1. Isometric of the main components of the uncapping machine

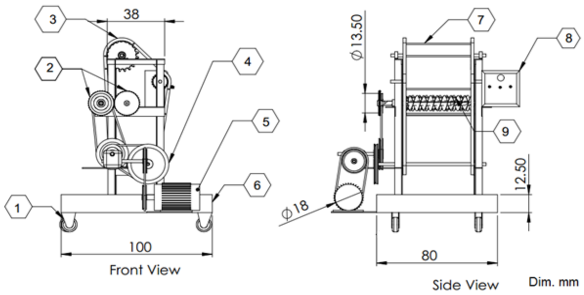

Fig. 2. Schematic diagram of the main components of the uncapping machine

1- Machine wheel 2-Two gears of spiral knifes. 3- Feeding chain 4- Feeding chain gear 5- Electrical motor 6- Wax hopper 7- Suspension skewer of frames 8- Electrical circuit 9- Two spiral knifes.

A. The uncapping device: The main part of the uncapping device is a spiral knife auger. Two parallel spiral knife was connected on each front and rear face of the honeybee frame to allow a spiral rotational motion for the knife. The two spiral knife was also fixed by two axis of 2 cm diameter and chair bearings on both sides at distance of 15 cm. Each spiral knife contains 14 blades of 11 cm diameter and 3 cm distance between each two blades. The clearance between the both spiral knives could be regulated by forward or backward to control the wax cutting depth . The Two parallel spiral knives were fixed horizontally relative to the longitudinal axis of the honey frame at the same distance from the longitudinal section of honey frame.

B. Power transmission: Fig. 3 shows the spiral knife was driven by 2.24 kW (3.0 hp), single phase electric motor. It was connected with bevel gear to reduce the speed from 1400 to 45 rpm (30:1) and inversely motion direction to cut the wax capping of both side the frame and regulate speeds of circular uncapper spiral knife to 150 (0.86), 200 (1.15), 250 (1.44), and 300 rpm, (1.73 m/s).

C. Feeding device: It consists of two chains each one moving by four toothed pinion gear where they are installed clamps on the chains to suspense honey frames by skewers with thickness of 6 mm. The frame feeding chain take the motion from main motor. Changeable sizes of pulleys and V belts were used to regulate the speeds of the feeding chain to 10 (0.07), 15 (0.11), 20 (0.14) and 25 rpm, (0.18 m/s).

Feeding mechanism: The honeycomb frames are manually feeding by labor into uncapping device. Feeding chain using to catch the frames in the vertical position depending on the frames thickness.

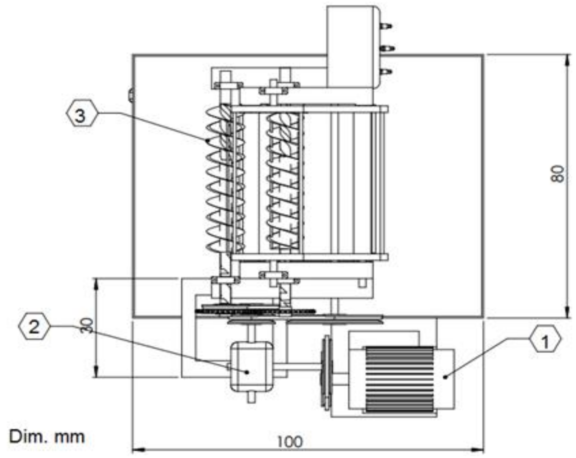

Fig. 3. Power transmission of the uncapping device

1- Electrical motor 2- Bevel gear 3- Spiral knife

D. Electrical circuit

The electrical circuit consists of:

Automatic switch: The automatic switch has 220 volts and used to connect and disconnect the power supply.

Heating circuit for the spiral knife: The heating circuit consisting of two heaters using one heater for each spiral knife auger because the movement of auger is circular. A stainless steel knife with grooves was assigned for receiving the heating coil then be attached to the blade. To regulate the heating coil for each auger to 35, 40 and 45 ^{0}C the power supply is ranged between 800 watts when the maximum temperature counter is 300 ^{0}C and 50 W when the minimum temperature counter is 35 ^{0}C.

Sensitive: Sensitive is a safety factor in the electrical circuit that disconnects temperature automatically if the temperature exceeds the required heat degree.

E. Wax hopper: The designed hopper was constructed from galvanized steel sheets (2 mm thickness) a rectangular shape (800×700 × 100 mm for length, width and height respectively). After uncapping honeycomb frame the wax falls down into the wax hopper to be drained through the on/off valve.

3-Uncapping honeycomb frame by manual knife

Fig. 3 and 4 show the honeycomb uncapping method using manual knife.

4. Experimental Procedures

Honeycomb was obtained from Beekeepers at Qalubia Government, Egypt, the six honeycomb frame were used for each evaluation.

Honeybee moisture content: Moisture content of honey was 18.1% and it was measured by digital refractometer. Moisture content of honey 18 – 20 % found to be the best levels to cut the lid off the honeycomb.

Fig. 4. Honeycomb frame

Fig . 5. Honeycomb uncapping with manual knife

Tests were conducted at laboratory for extracting honey. The feeding chain speed and spiral knife auger speed were selected according to the reducer gear box; then the actual speed during tests was measured three times for each nominal speed. The prototype was tested under the following parameters:

1- Four different feeding chain speeds (10 (1.05), 15 (1.57), 20 (2.09) and 25 rpm, (2.62 m/s)),
2- Four different spiral knife speeds (150 (15.7), 200 (20.93), 250 (26.17), and 300 rpm, (31.4 m/s)),
3- Four different temperatures for the uncapper device (Non heating, 35, 40 and 45 ^{0}C).

5- Measurements:

Prototype uncapping efficiency: To determine the uncapping efficiency the honeycomb frames were massed before feeding inside the prototype to determine the initial mass, g (M_i). After uncapping process they massed again to determine mass after leaving the prototype, g (M_m). Each frame was inspected and the additional wax was removed as necessary by hand and the sample was massed again to determine final mass, g (M_f). Uncapping efficiency (UE, %) was defined as the ratio of the removed wax mass by the machine to the total mass of wax expressed by (Srivastava *et al.*, 1997) as follows:

$$UE = \frac{M_i - M_m}{M_i - M_f} \times 100 \qquad (1)$$

The prototype productivity: It was determined in terms of the number of honeycomb frames which was removed the wax ones per time.

Specific energy consumption (SEC):

SEC, kWh Mg^{-1} was calculated using the following equation:

$$SEC\ (kWh\ frame^{-1}) = \frac{P\ (Power, kW)}{Pr\ (Productivity, frame\ h^{-1})} \qquad (2)$$

Power requirement: The total power requirement (P, kW) for uncapping prototype included both the power of a spiral knife with electric motor and the power of heating circuit. The total machine power was estimated from the following equation (Chancellor, 1981):

$$P = (I \times V \times \cos\theta) / 1000 \qquad (3)$$

Where:

P: Total power requirement for the uncapping prototype, kW.
I: Current strength, Amperes.
V: Potential difference, Voltage.
Cos θ: Power factor, equal 0.85.

6- Cost estimation of the uncapping honeycombs prototype:

The cost per hour of operation for the uncapping prototype was estimated as following:

A. Fixed and variable costs of the uncapping honeycomb prototype:

Fixed, variable and total costs incurred to wipe off the lid of a honeycombs could be calculated using the following equations (Suliman, 2007):

Fixed costs (Fc):

Fixed cost (EGP / h) = D +I + Si (0.045 Pm) / hours of use per year (4)

Where:

D: Depreciation costs, EGP/ year [= Pm – Sa / Lm], Pm: constructed cost of uncapping honeycomb machine, = 5000 EGP, Sa: Salvage rate when the machine full 7 years = 0.1 Pm, Lm: uncapping machine life= 7 years,
I: Interest costs, EGP/ year [= (Pm + Sa / 2) × in], in: Interest rate = 10 %,
Si:Shelter, taxes and insurance costs, EGP/ year = 0.045 Pm and Yearly operation = 720 hours / year.

Variable (operating) costs (Vc):

Variable costs (EGP / h) = R_m + E + La (5)

Where:

R_m: Repair and maintenance costs, EGP/ h (=100 % of D),
E: Energy (electricity) costs, EGP/ h [=Total electric power requirement, (1.0 kW) × Electricity price, (0.45 EGP / kWh)] and La: Labor costs, EGP/ h [= Salary of one labor, (7 EGP / h) × No. of labors (2)].

Total costs (Tc):

Total costs (EGP/ h) = Fixed costs (EGP/ h) + Variable costs, (EGP/ h) (6)

Total costs include profit (EGP/ h) = Total costs (EGP/ h) × Profit (1.20 %) (7)

Total cost (EGP/ frame) = Total costs include profit (EGP/ h) ÷ Productivity (frame/ h) (8)

B. Uncapping cost by using manual knife:

The practice one labor can uncap 60 frames of honey by manual knife in one hour. Salary of one labor (18 EGP/ h). (of Interviews with beekeepers)

$$\text{Uncapping cost per comb} = \frac{\text{Total wage cost } (\frac{LE}{h})}{\text{Capacity of one labour } (\frac{comb}{h})}, \text{ EGP/frame.} \qquad (9)$$

$$= \frac{18\ (\frac{EGP}{h})}{60\ (\frac{frame}{h})} = 0.3\ \frac{EGp}{frame}$$

RESULTS AND DISCUSSION

Uncapping Efficiency: Uncapping honeycomb efficiency parameters were the speed of spiral knife, feeding chain speed and temperature of spiral knife. The results recorded that, the uncapping honeycomb efficiency decreased with the increase of feeding chain speed at various levels of spiral knife speed under various levels of spiral knife temperature and non- heating (Figs. 6, 7, 8 and 9).

Under non- heating condition for spiral knife. Fig. 6 shows that the decrease in the uncapping honeycomb efficiency were 18.19, 20.4, 21.08 and 26.08 % as the feeding chain speed increased from 10 to 25 rpm at 150, 200, 250 and 300 rpm speed of spiral knife, respectively.

Under temperature of 35 ^{0}C for spiral knife. Fig. 7 shows that the uncapping honeycomb efficiency decreased by 15.78, 18.74, 20.91 and 24.45 % as the feeding chain speed increased from 10 to 25 rpm for 150, 200 , 250 and 300 rpm speed of spiral knife, respectively.

Under temperature of 40 ^{0}C for the spiral knife. Fig. 8 shows that the decrease in the uncapping honeycomb efficiency were 24.32, 26.46, 27.39 and 26.05% as the feeding chain speed increased from 10 to 25 rpm at 150, 200, 250 and 300 rpm speed of spiral knife, respectively.

Meanwhile, under temperature of 45 ^{0}C for the spiral knife Fig. 9 shows that the decrease in the uncapping honeycomb efficiency were 16.01, 25.84, 22.37 and 26.07 % as the feeding chain speed increased from 10 to 25 rpm for 150, 200, 250 and 300 rpm speed of spiral knife, respectively.

From the previous results the highest values of uncapping honeycomb efficiency were obtained with 10 rpm chain feeding speed and 300 rpm spiral knife speeds for different levels of temperature. However, the lowest values of uncapping honeycomb efficiency was obtained at 25 rpm chain feeding speed at 150 rpm of spiral knife speed at different levels of temperature. The previous results may be attributed to at 10 rpm of the feeding chain speed, the honeycomb frame get enough time to uncap under this appropriate speed of spiral knife. The knife uncapped combs at the rate of one frame per 15 seconds. Sufficient heat was available for this uncapping rate and the cut across the face of the comb was clean when the combs were filled and sealed. No scorching or caramelisation of honey during the uncapping process was detected equal to the average efficiency of 98.2 % of open-air space. Furthermore, increasing moisture content in pure honey more than 23% lead to honey fermentation Bogdanov (2010).

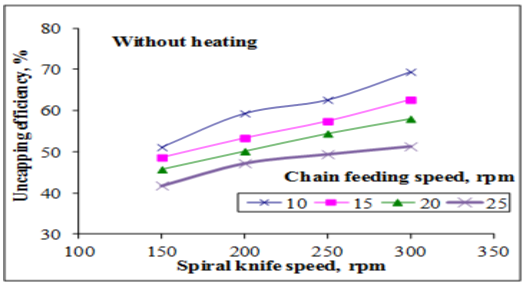

Fig. 6. Effect of the spiral knife speed on the uncapping efficiency at different levels of feeding chain speed without heating.

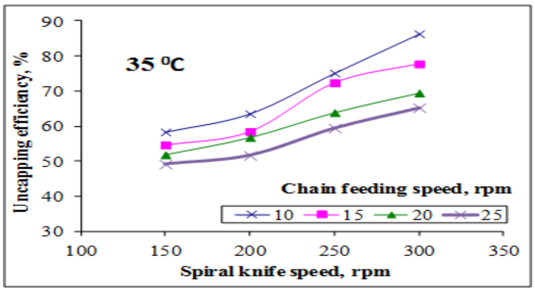

Fig. 7. Effect of the spiral knife speed on the uncapping efficiency under different levels of feeding chain speed at 35 ^{0}C.

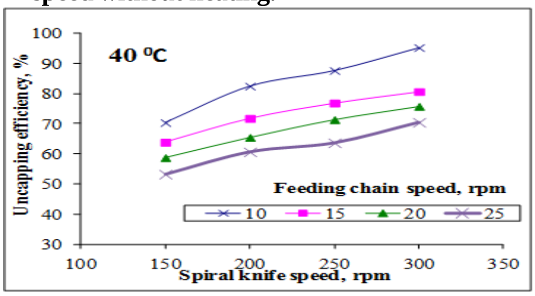

Fig . 8. Effect of the spiral knife speed on the uncapping efficiency under different levels of chain feeding speed at 40 ^{0}C.

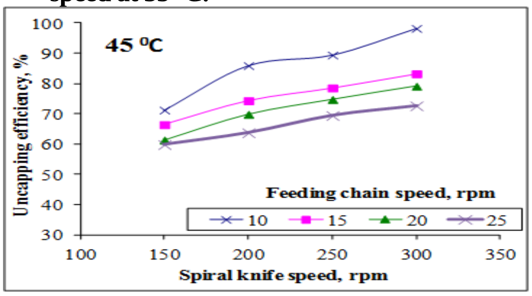

Fig. 9. Effect of the spiral knife speed on the uncapping efficiency under different levels of chain feeding speed at 45 ^{0}C.

The proper uncapping efficiency is not only selected based on the highest values of uncapping, but at 40 °C is the proper temperature because heating honey up to 40 °C leads to destruct many of organic material and the most important enzyme diastase (α -and β-amylase). It destroys invertase, and diastase activities (Melnyk, 2002; Oddo *et al*. 2004; Ruoff & Bogdanov, 2004). At the same time, heating leads to dehydrate sugar (fructose) and accumulate of HMF (Hydroxy methyl furfural) (Yuriy *et al*. 2006; Andreia *et al.* 2011).

A polynomial regression analysis was applied to relate the change in uncapping efficiency (UE) as dependent variable with the change in spiral knife speeds (S_k) , temperatures for uncapper device(T_e) and feeding chain speeds (S_f) as independent variable. The interaction between different treatments shows a significant effect with (R^2 = 0.93) and Stander Error of 3.34. The obtained regression equation was in the form of:

$$UE= 12.48 + 0.12\ S_k +1.43\ T_e - 1.13\ S_f \qquad R^2=0.93 \qquad (10)$$

Power requirement, productivity and specific energy consumption:

Table 1 shows the power requirement, productivity and the consumed specific energy for the developed uncapping machine at different operational conditions. Increasing the spiral knife speed from 150 to 300 rpm and spiral knife temperature from non heating to 45^0C caused a corresponding increase in the total power and consumed specific energy. The productivity increased from 240 to 600 frames h^{-1} by increasing the feeding chain speed from 10 to 25 rpm.

The highest consumed specific energy (9.3×10^{-3} kWh/frame) was recorded at 300 rpm spiral knife speed, 10 rpm chain feeding speed and 45^0C of spiral knife temperature, while the lowest consumed specific energy (1.3×10^{-3} kWh /frame) was recorded at 150 rpm spiral knife speed, 25 rpm feeding chain speed and non heating of spiral knife temperature, which is lower by 7.2 times than the highest one.

Cost estimation of the machine.

The construction costs of uncapping combs machine is 5,000 EGP. The practice labor one can uncap 180 combs of honey with this machine and 60 honeycombs by manual knife in one hour. The average wage of one labor, 18 EGP/ h (of Interviews with beekeepers).The constructed uncapping prototype was operated by electric motor of about 2.24 kW to operate eight hours a day, 90 days / year.

The total hourly cost for the uncapping combs machine was 22.30 EGP /h and the estimated cost was 0.1 EGP/ comb, this is in comparison with 0.3 EGP / comb for the simple blade type knife which is traditionally used. This means that the uncapping machine reduced the estimated cost by 3 times than the manual knife uncapping. The developed machine can be used comfortably by the Egyptian beekeepers.

Table 1. Power, productivity and specific energy consumed for uncapping machine at different operational conditions.

Spiral knife temperature °C	Feeding chine speed, rpm	Power requirement, kW				Pr, *f h^{-1}	Specific energy consumed, kWh *f^{-1}			
		Spiral knife speed, rpm					Spiral knife speed, rpm			
		150	200	250	300		150	200	250	300
Without heating	10	0.75	0.82	0.88	0.92	240	3.1×10^{-3}	3.4×10^{-3}	3.7×10^{-3}	3.8×10^{-3}
	15	0.78	0.83	0.89	0.93	360	2.2×10^{-3}	2.3×10^{-3}	2.5×10^{-3}	2.6×10^{-3}
	20	0.79	0.84	0.90	0.94	480	1.6×10^{-3}	1.8×10^{-3}	1.9×10^{-3}	1.9×10^{-3}
	25	0.80	0.86	0.91	0.95	600	1.3×10^{-3}	1.4×10^{-3}	1.5×10^{-3}	1.6×10^{-3}
35 °C	10	1.87	1.94	2.00	2.04	240	7.8×10^{-3}	8.1×10^{-3}	8.3×10^{-3}	8.5×10^{-3}
	15	1.90	1.95	2.01	2.05	360	5.3×10^{-3}	5.4×10^{-3}	5.6×10^{-3}	5.7×10^{-3}
	20	1.91	1.96	2.02	2.06	480	4.0×10^{-3}	4.1×10^{-3}	4.2×10^{-3}	4.3×10^{-3}
	25	1.92	1.98	2.03	2.08	600	3.2×10^{-3}	3.3×10^{-3}	3.4×10^{-3}	3.5×10^{-3}
40°C	10	1.96	2.04	2.09	2.13	240	8.2×10^{-3}	8.5×10^{-3}	8.7×10^{-3}	8.9×10^{-3}
	15	1.99	2.05	2.10	2.14	360	5.5×10^{-3}	5.7×10^{-3}	5.8×10^{-3}	5.9×10^{-3}
	20	2.00	2.06	2.11	2.15	480	4.2×10^{-3}	4.3×10^{-3}	4.4×10^{-3}	4.5×10^{-3}
	25	2.01	2.07	2.12	2.17	600	3.4×10^{-3}	3.5×10^{-3}	3.5×10^{-3}	3.6×10^{-3}
45°C	10	2.06	2.13	2.19	2.23	240	8.6×10^{-3}	8.9×10^{-3}	9.1×10^{-3}	9.3×10^{-3}
	15	2.09	2.14	2.20	2.23	360	5.8×10^{-3}	5.9×10^{-3}	6.1×10^{-3}	6.2×10^{-3}
	20	2.09	2.15	2.21	2.24	480	4.4×10^{-3}	4.5×10^{-3}	4.6×10^{-3}	4.7×10^{-3}
	25	2.11	2.17	2.22	2.26	600	3.5×10^{-3}	3.6×10^{-3}	3.7×10^{-3}	3.8×10^{-3}

***Pr : productivity** ***f : frame**

CONCLUSION

1-The developed uncapping machine can be successfully worked at the optimum operating parameters of 10 rpm feeding chain speed, 300 rpm spiral knife speed and 40 °C of spiral knife temperature. These operating conditions cause an uncapping efficiency of 95.2 %, productivity of 240 frame / h, specific energy of 8.9×10^{-3} kW.h/frame.

2- The total hourly cost for uncapping combs machine was 22.30 EGP /h and the estimated cost was 0.1 EGP/ comb, this is in comparison with 0.3 EGP / comb for the simple blade type knife which is traditionally used.

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تطوير وتقييم آلة لكشط برواز شمع العسل

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يهدف هذا البحث إلى تطوير وتصنيع واختبار أداء آلة كشط برواز عسل النحل وذلك للمناحل الانتاجية المختلفة. تعتمد الفكرة الاساسية لهذه الالة على كشط برواز عسل النحل بين سكينتين حلزونيتين لوجهى برواز عسل النحل وذلك بإزالة الطبقة الشمعية الموجودة على البرواز وذلك لتفتيحه وتجهيزه لعملية الفرز. وتتم عملية التغذية المستمرة بواسطة سير تغذية مثبت على اربع تروس ويسع هذا السير ست براويز يتم تغذيتها يدويا بواسطة مشبك تعليق على هذه السلسلة. يسقط الشمع المزال من البراويز الى اسفل متجمعا فى حوض تجميع الشمع وتتم التغذية المتوالية للبراويز الجديدة بعد ازالة البراويز القديمة وهكذا تتم عملية الكشط الالى. تم تقييم أداء آلة كشط برواز عسل النحل تحت متغيرات مختلفة على النحو التالي:- 1- أربع سرعات دورانية مختلفة لسكينة القطع الحلزونى هى 150 , 200 , 250 و 300 لفة / دقيقة. 2- اربع سرعات لسير تغذية البراويز هي 10 , 15 , 20 و 25 لفة / دقيقة. 3- أربع مستويات تسخين لسكينة القطع الحلزونى هي بدون تسخين , 35 , 40 , 45 درجة مئوية. تم دراسة تلك المتغيرات على كفاءة آلة كشط برواز عسل النحل وإنتاجية الآلة والطاقة النوعية المستهلكة وكذلك حساب التكاليف والتقييم المالي للآلة مقارنة بالكشط اليدوى وكانت أهم النتائج المتحصل عليها من التجارب على النحو التالي:- تم الحصول علي أنسب كفاءة كشط لبرواز عسل النحل عند 300 لفة / دقيقة لسرعة دوران سكينة القطع الحلزونى و 10 لفة / دقيقة لسرعة سير التغذية و 40 درجة حرارة تسخين لسكينة القطع الحلزونى. عند هذة الظروف سجلت الالة انتاجية 240 برواز / ساعة وكذلك الطاقة النوعية المستهلكة كانت 8.9×10^{-3} كيلو وات / اطار. بلغت التكلفة الكلية لتشغيل آلة كشط برواز عسل النحل حوالي 22.30 جنية / ساعة وكذلك تكاليف تشغيل كانت 0.1 جنيه / للبرواز مقارنة ب 0.3 جنية / للبرواز للكشط اليدوي. ذلك يعنى ان هذه الالة اقتصادية وتوفر التكاليف بمقدار ثلاث مرات عن الكشط اليدوى.