Component Analyse and Carcinogenic Performance Research after Food Material Baked to Be Roasting

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Abstract: Food cooking include the methods such as oil frying, baking, carbon baking, stewing. Among, oil frying, baking, carbon baking and other method cooking at higher temperature and difficult to control. High temperature cooking will caused the foods come to be roasting, many medias reported that burned in roasting or oil fried foods easily carcinogenic. To proof and test the reliability of this conclusion and research the true harm of this type foods, it selects the chicken, steam bun and celery as sample, baking the samples under different temperature and time condition, the samples happened different degree burnt. It obtained that the food happen carbonize after foods burned in roasting, the chemical structure of protein, starch and cellulose all are changed, generated the acrylamide and conjugate aromatic ring chemical compounds, thus generating carcinogenic performance to human body.

1 INTRODUCTION

More and more higher opportunity catch cancer in the modern society, according to the report from national tumour register center in 2013, the newly happened cancer illness case exceed 3,000,000 per one year (Liu, 2021). Much reason of cancer, many medias reported that, oil frying, baking, carbon baking and other methods cooked foods easily caused cancer. The report said that baked meats contain strong carcinogenic performance, the meat and fish burned in roasting contain benzopyrene, the average catch gastric caner ratio of the crowds who frequently eat the baked meat type foods rising twenty times (Ye, 2016). Additionally, for the plant food like coffee and others, the content of benzopyrene after burned in roasting also will has extremely rising (Yin, 1980).

Our daily foods have meat, staple food type and vegetable type. (1) The main component of meats are protein, protein is one type biology big molecule, formed by 20 types different natural amino acids. The structure of natural amino acid mainly contain the elements such as carbon, nitrogen, oxidize, hydrogen, etc, additionally, R-perssad of some amino acid contain the sulphur element. The amino acid structure of meats been damaged after baked, the protein happen property change, and caused possible carcinogenic. (2) The food mainly include wheat and rice, the main component is starch. The form of starch main are three elements carbon, oxygen and hydrogen. The starch burned in roasting will generate strong carcinogenic matters, the content of carcinogenic matters will higher than meat type and vegetable, long time eating will caused it amass in body and carcinogenic (Yiqi W, 2021). (3) The main components of most vegetables are cellulose, it contain the elements such as carbon, nitrogen, oxidize, hydrogen, etc. Because fewer carbonhydrate and fat content, so the burned vegetable will generate polycycline carcinogenic matters (Chu, 2021).

Based on various reports of the medias, burned food has carcinogenic performance, but still has many report existing contradiction. Therefore, in this research, it selected three foods chicken, steam bun and celery in our test, the main components are protein, starch, cellulose and other matters, baking them under different temperature, further more adopt infrared spectrum (FT-IR), scan electron microscope (SEM), UV light spectrum (UV-Vis), fluorescence spectrum and other method to to determine and characterize the baked foods components. Finally researched the carcinogenic performance of baked foods through cell toxicity test.

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2 METHODOLOGY

2.1 Materials

The chicken, steam bun and celery all are purchased from Suzhou HEMAXIANSHENG supermarket. Purchased grow liquid, trypsase, Diphenyl tetrazole bromide and glycocoll buffer liquid from Sigma company, purchased dimethyl sulfoxide (DMSO) from J&K scientific company.

2.2 Sample Preparation

Use knife cut the chicken, steam bun and celery into small cube with size 1cm×1cm×1cm, use oven (ACA TM33HT) baking them under 150℃ and 200℃ respectively, the baking time are 1 hour, 2 hours and 3 hours respectively, pick out the samples from the oven after baked and process natural cooling, prepare for characterize use.

2.3 Characterized Methods

(1) UV-Vis ultraviolet spectrophotometer method

Grind the baked samples to be thin and small tiny pellets, weighing 1mg and dissolved into 10mL deionized water and process ultrasound, convenient to more better dissolve the samples. The dissolved samples filtered by 0.45μm filtering film, make the deionized water as reference ratio, use ultraviolet spectrophotometer measure it after filtered (Shimazu), measured wave length are 220~400nm.

(2) Fourier alternate infrared spectrum analyse

Use PerkinElmer Fourier alternate infrared spectrum analyse instrument to process characterize analyse (resolution ratio 4cm-1, wave length range are 4000-400cm-1, scan 10 times).

(3) Fluorescence spectrum analyse

Use fluorescence spectrum instrument (Hitachi F-7500), excite wave length 300nm, launch wave length range are 220~400nm, width of excite and launch narrow seam is 5nm.

(4) Surface pattern analyse

Adopt scan electron microscope (SEM, Hitachi S4800) to process the surface pattern analyse the samples chicken, steam bun and celery after baked at different temperature, operating voltage is 1.0kV.

2.4 Cell Toxicity Test

Use foster base thinning the waiting test sample and prepare different concentration, added into 96 holes plate respectively, foster 24h at 37℃, then process three times parallel determining at live cells quantity. Then pick out empty 96 holes plate, each one hole added 200μL foster base and 50μL MTT, foster 4h at 37℃. Then added 200μL DMSO in each one hole again. Finally added 25μL glycocoll buffer liquid in each one hole, use enzyme standard instrument record the completely absorb value at 570nm position.

3 RESULT AND DISCUSSION

3.1 Sample Preparation

The main components of chicken, steam bun and celery are protein, starch and cellulose, put them into oven and baking under different temperature and time, the sample surface happened different degree coking. It calculated the rest mass percentage after samples baked, shown as the Table 1.

From the table it can see that, when same baking time and temperature, the highest dewatering quantity of celery, able to achieve 94% after baked 3 hours at 150℃, achieve 98% after baked 3 hours at 200℃, means water content of celery is the highest, chicken at second, achieve 78% after baked 3 hours at 200℃, lowest water content of steam bun, only 42% after baked 3 hours at 200℃. When baking at the same temperature, example that baked at 150℃, dewatering quantity of celery and chicken have a certain rising along with rising baking time, but little dewatering quantity change of steam bun. When all samples baked at the same time, example all are baked 3 hours, the dewatering quantity of same sample after baked at 200℃ will bigger than dewatering quantity after baked at 150℃.

Table 1: The dewatering quantity of chicken, steam bun and celery after baked at 150℃ and 200℃.

	Dewatering quantity of different samples baked different time at 150℃			Dewatering quantity of different samples baked different time at 200℃		
	1h	2h	3h	1h	2h	3h
Chicken	70%	74%	76%	76%	78%	78%
Celery	88%	94%	94%	90%	96%	98%
Steam bun	38%	38%	38%	40%	42%	42%

3.2 Sample Extinction Change After UV-Vi Surface Characterize Baked

Figure 1 is the UV-Vis atlas of chicken, steam bun and celery after baked 1h at 150℃ and 200℃ respectively. The chicken occur absorbing at 220~240nm position after baked at 150℃, occur peak absorbing at 220nm after baked at 200℃, and more higher peak absorbing strength, means the generated matter quantity which able to ultraviolet absorb increasing. The steam bun no peak absorbing in the measured wave length range after baked, but occur peak absorbing at 280nm position after baked at 200℃. The celery occur one more higher peak absorbing at 220nm after baked at150℃, but except occur one peak absorbing at 220nm position after baked at 200℃, also occur one absorbing at 290nm position. The steam bun and celery all generated absorbing at about 280nm after baked at 200℃, generally, the absorbing at this position is the continue conjugated alkene or aromatic chemical compound with fewer rings. Through check the documents, the peak absorbing of acrylamide at 280nm, means this matter maybe acrylamide (shown as the below picture). According to report in documents, starch and cellulose types matters easily happen Maillard reaction under that heating under high temperature condition and generate acrylamide (Zhi-Jing N, 2021), through our test we found that, the acrylamide generated by that baking steam bun and celery at 200℃ more than baking at 150℃.

3.3 Fourier Alternate Infrared Spectrum Characterize Result

Figure 2 is the Fourier alternate infrared spectrum of steam bun and celery after baked 1h at 150℃ and 200℃. At the position 3500cm-1, the celery all have one wide peak when baked 1h at 150℃ and 200℃, this is stretch vibrating peak of oxhydryl of glycoconjugate structure on cellulose, stretch vibrate peak of -CH- at position 2900cm-1, stretch vibrate peak of C=C and C=O double keys at position 1600cm-1. The function group of chemical structure of celery baked 1h at 150℃ and 200℃ no obvious changes. The infrared spectrum of steam bun after baked 1h at 150℃ and 200℃ also no obvious changes, this means the types of function group on steam bun no changes.

3.4 Fluorescence Photometer Analyse of Samples After Baked

Figure 3 is the fluorescence spectrum of chicken, steam bun and celery baked 1h at 150℃ and 200℃. The launched fluorescence light intensity about 2 times of that baked 1h at 150℃ after the chicken baked at 200℃. At the same time, the launched fluorescence spectrum of chicken after baked at 200℃ happen infrared shift compare to the sample baked at 150℃, the max fluorescence strength of samples after baked at 200℃ about 490nm, but the max fluorescence strength of samples after baked at

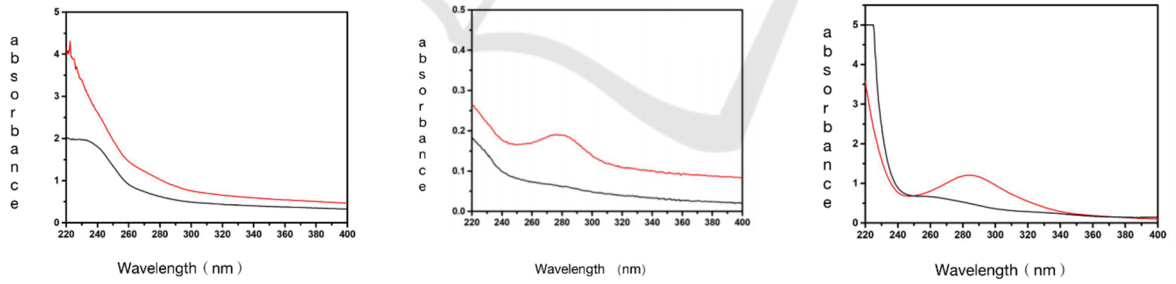

Figure 1: UV-Vis atlas of chicken, steam bun and celery after baked 1h at 150℃ (black line) and 200℃ (red line).

Figure 2: The Fourier alternate infrared spectrum of steam bun and celery after baked 1h at 150℃ and 200℃.

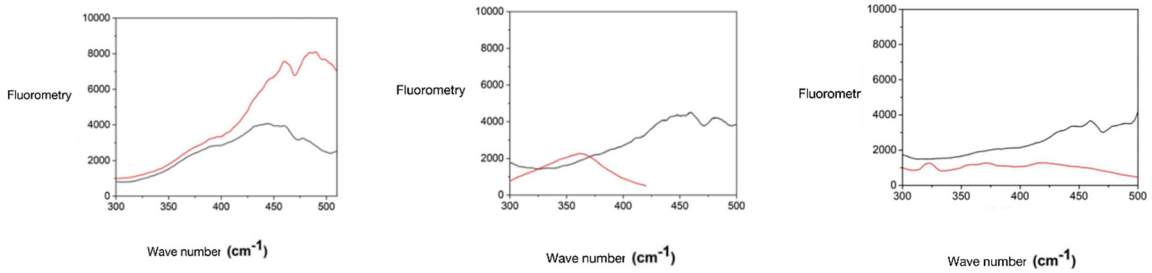

Figure 3: The fluorescence spectrum of chicken, steam bun and celery baked 1h at 150℃ (black line) and 200℃ (red line).

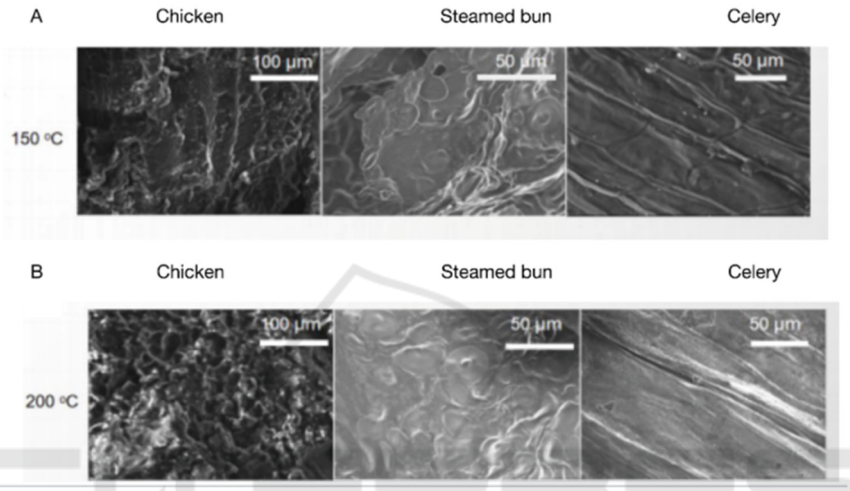

Figure 4: The SEM pictures of chicken, steam bun and celery after baked 1h at 150 and 200℃.

150℃ occur at about 445nm. Means that samples baked at 200℃ maybe generate the related conjugate structure. After the steam bun baked at 150℃ and 200℃, under the same excite light and same sample concentration situation, the fluorescence strength greatly reduced, the max fluorescence strength of steam bun baked at 200℃ about half of chicken, at the same time, the longest wave length of fluorescence launch spectrum also only about 460nm. The fluorescence strength of celery baked at 200℃ closes to the fluorescence strength of steam bun baked at 200℃, and the longest launch wave length of light spectrum also closed, means the structure of celery and steam bun baked at 200℃ are similar.

3.5 Scan Electron Microscope Observe the Surface Structure After Samples Baked

Figure 4 is the SEM pictures of chicken, steam bun and celery after baked 1h at 150℃ and 200℃. Firstly, the chicken samples occur holes after baked at 150℃ and 200℃, especially that we can check more bigger density of holes through scan electron microscope after chicken baked at 200℃. Secondly, sample surface of steam bun after baked looks more flat, but still able to observe the celery internal fibre tube structure of celery through SEM after celery samples baked, this means that high temperature baking still not destroy the internal fibre tube structure of plant.

3.6 EDX Result of Chicken, Steam Bun and Celery

Then it determined the EDX result of chicken, steam bun and celery baked 1h at 150℃ and 200℃ respectively. To the chicken and steam bun, the EDX spectrum chart after baked 1h at 150℃ and 200℃ all only contain elements C and O, and the percentage of element C and O no obvious changes. The component of celery baked at 150℃ and 200℃ has more obvious changes. Firstly, the celery self contained more element types, except the elements C and O, still contain the elements such as Na, Mg, P, S, Cl, K and Ca, element types after baked almost no changes, but percentage of each element has

changes. Example, the percentage of elements C and O a little reducing, the percentage of elements Na, Cl and K a little rising, the reason maybe that high temperature baked elements Na, Cl and K will not form the volatilized matters and leave sample, so the percentage has a little rising.

3.7 Cell Toxicity Test

Evaluating the cell toxicity of chicken, steam bun and celery samples baked at different temperatures and different concentration (0, 10, 50 and 100mg/mL) through MTT method. This test select the mouse embryo fibroblast (NIH-3T3) to process the cell toxicity test. From figure 5, we can know that, through place the NIH-3T3 cells into sample suspending muddy liquid and foster 2h, in comparison, the cell toxicity of chicken, steam bun and celery after baked at 200℃ more bigger than samples baked at 150℃, the max cell toxicity of samples when concentration at 100mg/mL.

4 CONCLUSION

Process characterization for the chicken, steam bun and celery samples which baked at 150℃ and 200℃ through the test methods such as UV-Vis, Fourier alternate infrared spectrum, fluorescence spectrum, scan electron microscope and EDX energy spectrum, found the foods after high temperature baked will generate aromatic ring chemical compound, acrylamide and other matters, these matters all contain a certain toxicity. The cell toxicity test result proof that, the baked foods will generate a certain toxicity to cells under a certain concentration. From here it can see that, no matter meat types, starch types and vegetable types foods, all shouldn't be long time high temperature cooked during the cooking process, if high temperature cooking then will generate toxicity matters and harm to human body.

Table 2: The EDX result of chicken, steam bun and celery baked1h at 150℃ and 200℃.

Element		150℃		200℃	
Chicken	C K	71.52	76.98	80.34	84.48
	O K	28.48	23.02	19.66	15.52
Steam bun	C K	51.14	58.23	51.01	58.11
	O K	48.86	41.77	48.99	41.89
Celery baked	C K	51.77	63.58	49.73	63.86
	O K	31.12	28.69	25.51	24.59
	NaK	02.72	01.74	05.01	03.36
	MgK	00.80	00.49	00.69	00.44
	P K	01.79	00.85		
	ClK	04.88	02.03	09.47	04.12
	MoL			00.58	00.09
	K K	03.59	01.35	07.35	02.90
	CaK	02.89	01.06	01.66	00.64

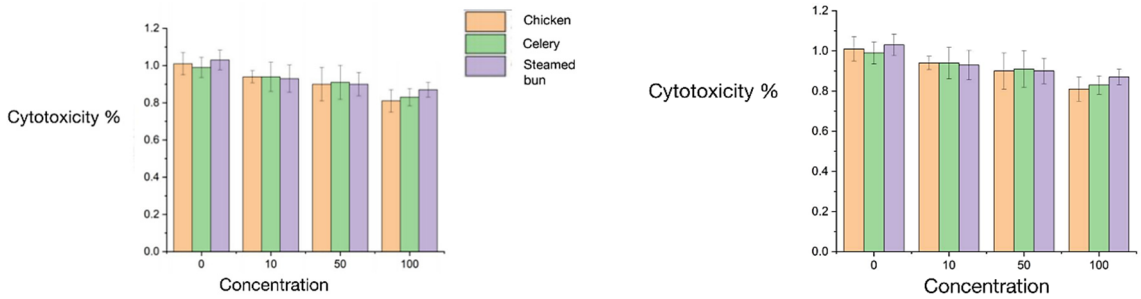

Figure 5: The cell toxicity test of chicken, steam bun and celery samples baked 1h at 150℃ and 200℃.

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