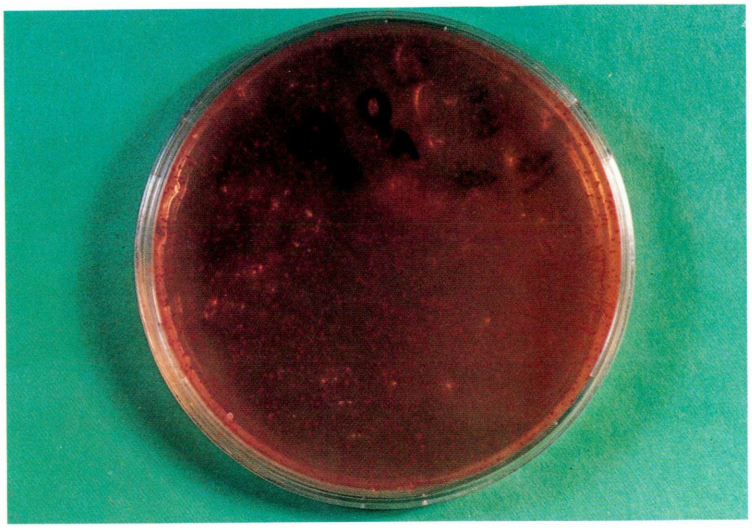
食中毒菌検出培養の写真

（神野節子・土居則子原写真）



デソキシコレート寒天（赤変コロニー）

EMB平板　（鉄サビ色コロニー）

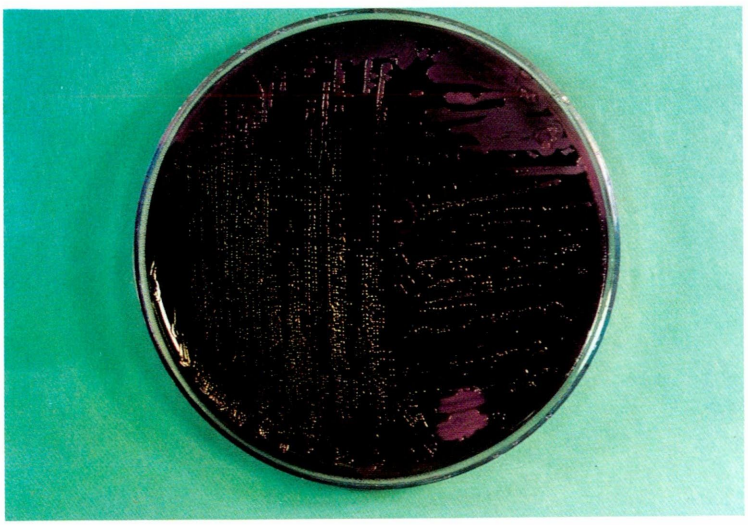


写真１　大腸菌群（A）

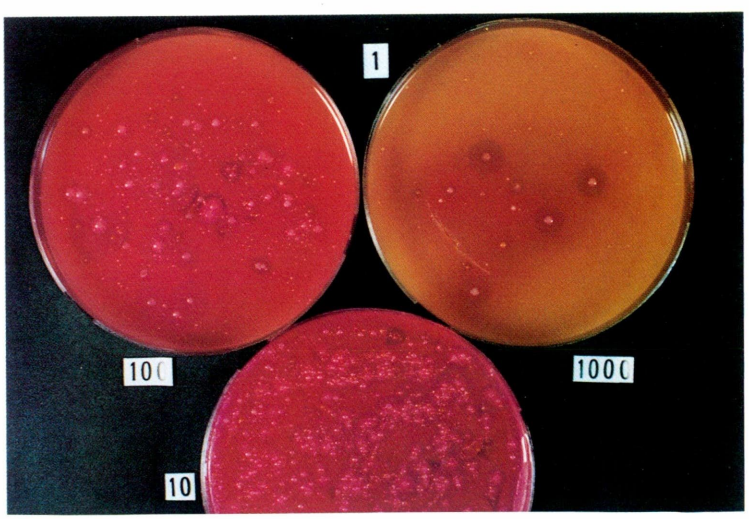


写真２　セレウス菌（A）　　20%卵黄加 NGKG 寒天培地（透明環）

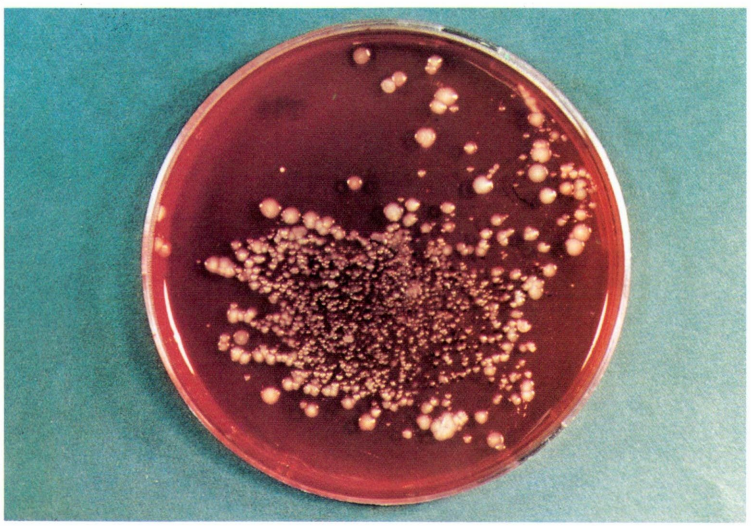


写真３　カンピロバクター（Ａ）　　スキロー培地

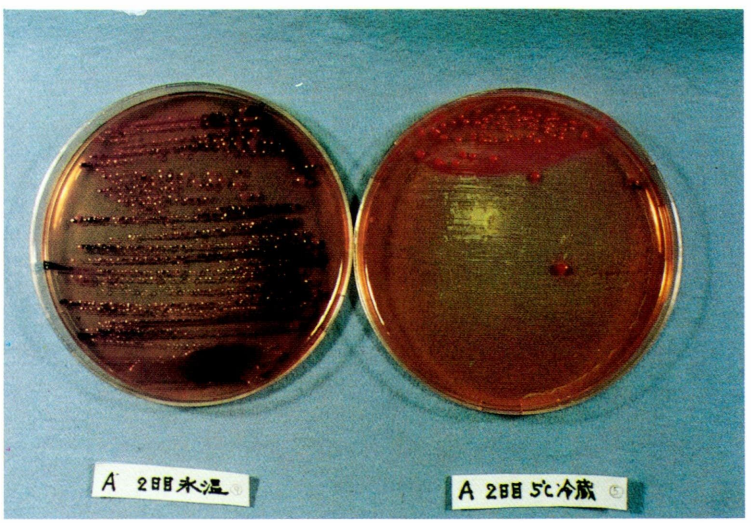


写真４　推定サルモネラ菌　　ラパポート増菌培地→ＤＨＬ寒天培地に塗抹

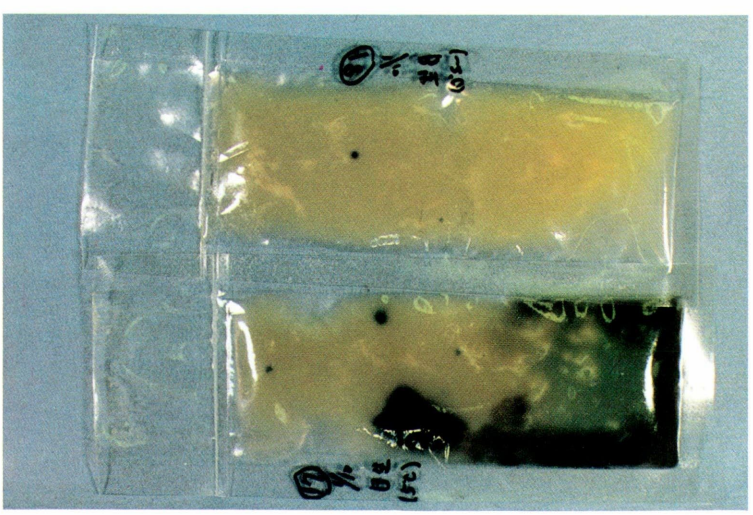


写真５　ウェルシュ菌（Ｂ）　ハンドフォード改良培地　　（黒変コロニー）

食品の新しい保蔵と利用に関する研究

神野節子，土居則子，木元幸一，宇高京子，堀津圭佑

Setsuko KANNO, Noriko DOI, Koichi KIMOTO
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I　はじめに

鶏肉の内部肉（ササ身）を検体として，従来の保蔵方法である冷蔵，冷凍，そして新しい氷温――この実験中に，一般普及化して，既に新しいと云えないけれど――保蔵との比較実験をおこなった。

それらの三温度条件下における一般生菌数の消長，食中毒菌の検出と挙動，鮮度指標としてのK値の測定，プロテアーゼ活性，さらに筋組織上の変化などから，品質保持に最適な保蔵法をえようとしたものである。

従来の報告例には，これらの総合的な知見はみられず，初めてのこころみと思えた。

鶏肉（ササ身）の貯蔵温度と細菌の消長ならびに組織的変化についての実験成績は東京家政大学生活科学研究所報告　第10集に，つづいて鶏肉と真鯵の貯蔵に於ける鮮度の研究は，同じ第11集に報告し，その間，1987年度日本家政学会総会（５月３日岡山大学）において，保蔵温度と，食中毒菌（大腸菌群，病原ブドウ球菌，カンピロバクター，セレウス菌，ウェルシュ菌，サルモネラ菌）や一般生菌数の消長について発表した。

ここでは，最初に供試した，保蔵温度５℃冷蔵，－２℃氷温，－18℃冷凍した，鶏肉ササ身A.（都内鶏肉専門店に殺菌マナ板と，消毒綿と塩化ビニール手袋を持参して，解体時に出来るだけ無菌的に配慮してやっていただくよう特注したもの。解体処理を待って，直ちに蓄冷剤入発泡スチロールボックスで運び，４時間以内の供試検体）についてのみ，表１にまとめた。

II　実験方法

写真１　は，大腸菌群の検出を，調製試料液１mlを滅菌シャーレに入れ，約45℃デソキシコレート寒天を混釈平板とし，凝固後，薄く1.5％寒天を重層して，37℃で18時間培養後赤変コロニーを算定し，赤変菌をＥＭＢ培地平板に塗抹し，37℃，24時間培養後，鉄サビ色に光輝する *Escherichia coli* の定型コロニーの有無を調べた。さらに，定型を示すコロニーの１つを普通寒天斜面とＢＴＢ加乳糖ブイヨンに接種して，37℃，24時間培養して，大腸菌群の形態的特性，グラム陰性無芽胞桿菌，乳糖分解能とガス発生の生理的性質を肉眼観察した。必要により，さらに，鑑別試験も行った。

写真２　は，20％卵黄加ＮＧＫＧ寒天培地に検液0.1mlを滴下し，コンラジ棒で拡散後30℃で24時間培養した。培地のピンク色透明環の出来たコロニーをセレウス菌として算定した。

写真３　は，スキロー培地上に0.1ml検液を滴下して，塗抹後35℃，24時間培養して出現した定型コロニーを数えた。

写真４　推定サルモネラ菌の分離のために，先ず，ラパポート増菌培地中で検体を35℃，48時間培養後，ＤＨＬ寒天培地上に１白金耳塗抹

表１．鶏肉ササ身（Ａ）の品質と保蔵温度

試験項目＼温度℃・日数		5					−2				−18	
		0	2	3	7	14	2	3	7	14	7	14
一般生菌数 S.P.C. /g		— 検出されず	1.2×10^3	3.8×10^3	1.2×10^7	3.8×10^8	L.A.	3.6×10^2	8.9×10^2	2.5×10^5	4.9×10^2	3.0×10^2
K 値 %		5.95	19.5	23.8	40.0		12.0	17.7	31.7			
プロテアーゼ活性	自己消化活性	0.02		0.02	0.12	0.44		0.05	0.18	0.17		
	酸性プロテアーゼ	0.13	0.15	0.10	0.22	0.27	0.16	0.17	0.25	0.27		
	中性プロテアーゼ	0.09	0.05	0.04	0.20	0.21	0.09	0.02	0.11	0.12		
筋組織の変化		正	変化なし	変化なし	膜破壊	細胞消失	変化なし	変化なし	少し変化	少し破壊	氷結破壊	氷結破壊
推定食中毒菌	大腸菌群 /g	—	1.2×10^2	—	4.5×10^2	—	1.4×10^2	3.5×10	—	—	—	—
	病原ブドウ球菌 /g	—	5.0×10^2	—	4.0×10^3	—	—	—	—	—	—	—
	セレウス菌 /g	3.0×10^2	1.5×10^2	4.9×10^3	1.4×10^8	4.7×10^8	—	—	1.5×10^3	5.3×10^6	—	—
	カンピロバクター /g	—	9.0×10^2	1.6×10^3	3.2×10^5	4.9×10^7	1.1×10^3	—	—	—	—	—
	ウェルシュ菌 /g	—	—	—	—	—	—	—	—	—	—	—
	サルモネラ菌 /g	—	—	—	—	—	—	—	—	—	—	—

備考：— 菌検出されず

して，35℃，24時間培養，黒色単離コロニーを，ＴＳＩ寒天とＬＩＭ培地斜面に接種し，35℃，24時間培養した。Ａ検体ササ身からは，陽性菌は出現しなかった。

写真５　ウェルシュ菌検出用のハンドフォド改良培地15mlに検液10mlを加え，シールして，嫌気条件下で，46℃，24時間培養して，黒色コロニーを陽性とした。

その他　　写真には示さなかったが，病原ブドウ球菌の検出には，３％卵黄加マンニット食塩寒天平板上に0.1ml検液を加えてコンラジ棒で拡散し，35℃，48時間培養し，定型コロニーを陽性として算定した。

Ⅲ　実験結果及び考察

表１に示した実験結果Ａ検体の一般生菌数，推定食中毒菌（大腸菌群，病原ブドウ球菌，セレウス菌，カンピロバクター，ウエルシュ菌，サルモネラ菌），Ｋ値，プロテアーゼ活性（自己消化活性，酸性プロテアーゼ，中性プロテアーゼ），筋組織の変化に関して，５℃冷蔵，－２℃氷温と－18℃冷凍しておいたササ身についての保蔵温度による変化を比較検討した結果，冷蔵にくらべ，氷温保蔵が優れていることが証明された。すなわち，購入直後には，セレウス菌が300／ｇ検出されたのみで，標準寒天による一般生菌数は10倍希釈液からは検出されない程微生物汚染のすくないササ身であったが，冷蔵すれば，７日後には一般生菌数は10^7／ｇをこえ，腐敗の初期段階に達し，Ｋ値も40.0％と，煮沸加熱して食す鮮度となり，大腸菌群，病原ブドウ球菌，セレウス菌，カンピロバクターが検出され，筋組織の細胞の細胞壁の破壊が見られる状態となった。特に，セレウス菌は10^8／ｇを超え，カンピロバクターも10^5／ｇをこえ，これらの菌による食中毒の可能性が推定された。一方，氷温保蔵ササ身は，７日の保蔵では一般生菌数は8.9×10^2／ｇで，食中毒菌のうち，セレウス菌のみ約10^3／ｇでこの菌数では，食中毒は推定出来ず，その他の食中毒菌の増殖は抑えられた。Ｋ値は31.7％と，加熱して食せる鮮度を示し，筋組織細胞も殆んど変化ない状態に維持された。

冷凍の場合は，微生物の増殖は阻止された。しかし，筋組織細胞から自由水，セミ結合水がはき出され，出された水分が凍結して，細胞が小さくなった。ササ身内細胞に出来た氷結晶が組織を破壊し，損傷するので，旨味や，色や鮮度嗜好の現代の要求に必ずしも適合しない。

今回のササ身検体は，無菌的に配慮して内部から取り出した直後，蓄冷剤入保存箱で４時間保蔵した特注品であったが，市販品は，多くの研究者の報告，また筆者らが本報告第10集中で報告している毎く，一般細菌数$10^{5\sim6}$／ｇ当りの品が多く，なかには，既に腐敗の初期段階に達していたものもあった。（Ｄ）検体として報告している通り，冷蔵では２～３日後に生菌数は10^8／ｇ以上となり腐敗して来る。食中毒菌も，推定食中毒可能菌数に増殖する。Ｋ値も，３日後67.3％と食用不可を示している。タンパクも変性していた。第10報で報じたごとく市販品の多くは購入時生菌数10^5／ｇ当以上では３日冷蔵すると食べるのに一般的に（検体によって異なるが）適さなくなる。

普通市販品で購入時ササ身の生菌数で10^5／ｇ以上のものは，氷温保蔵の場合でも２日までは食されても，３日目の一般生菌数10^7／ｇ以上となり，初めの菌数が多いと，腐敗の初期段階に達する。Ｋ値は氷温のものは31.7％と未だ加熱して食せば良い鮮度ではある。

そこで，我々は，鶏肉の保蔵に冷蔵は勿論のこと氷温貯蔵も過信出来ないので，１つは，国の鶏肉の市販品に対する他の食肉類と同様な検査制度の設定を希望していたが，漸くその機運が熟した。また各地域の保健所による食肉取扱業者への解体と殺処理場，と殺器具，取扱者の清浄の指導により，消費者の我々に，微生物汚染の少ない，鮮度のよい市販品の販売を願う。

鶏肉(ササ身)の各貯蔵温度と蛋白質の変化

宇高　京子

1. はじめに

牛肉や豚肉のような獣肉に比較して鶏肉は，淡白で肉質も軟らかく安価なため，広く用いられている。しかし鮮度低下が著しいので低温貯蔵が必要とされる。冷凍，冷蔵の他にも，最近ではパーシャルフリージング，氷温貯蔵など新しい貯蔵方法が研究，開発されてきている[1)~4)]。これらの方法は刺身やたたき等として生鮮状態で消費する場合は言うにおよばず，加工原料として利用する場合にも重要である。

そこで著者は，各種ダイズの貯蔵蛋白質の変化に関する分析技術をもとに，このプロジェクトに参加し，鶏肉（ササ身）の各貯蔵温度における蛋白質の変化に関する研究を行なった。

2. 実験方法

1. 試料

実験に用いた鶏肉は，東京都内のA店から，12検体（ササ身21本），B店から16検体（29本）であった。試料の処理方法は前報[5)]の通りおこなった。

2. 貯蔵条件

検体A（取扱い特注品）と検体B（一般市販品）について，冷凍（−18℃），冷蔵（5℃），氷温（−2℃）の3温度条件下に放置貯蔵して，7日間の変化を比較した。

3. 試料の調製

それぞれの検体（試料）に10倍量の0.6M-食塩を含むバルビタールバッファー（pH8.0）でホモジナイズし，得られたホモジネートを小ビーカーに入れ，60分以上攪拌し（4℃），18,000 rpmで20分間遠心分離した。得られた上澄液をゲル濾過法およびSDS電気泳動法に用いた。

4. ゲル濾過法

Bio-gel A-1.5m（Bio Rad 社製）によりゲル濾過をおこなった。0.6M-食塩を含む0.01M-バルビタールバッファー（pH8.0），カラムサイズ26×820mm，流速0.5ml／min，10mlずつ集め，280nmで吸光度を測定した。

5. SDS−ポリアクリルアミド電度泳動法

U. K. Laemmli らの変法による蛋白質サブユニットの検定をおこなった[6)]。すなわち，12%分離ゲルと5%濃縮ゲル，トリス塩酸バッファー（pH8.8，pH6.8），トリス-グリシン電気泳動用バッファーである。150Vから200Vで5時間から6時間電気泳動。1% coomassie Brillant Blue R250で1時間染色，7%酢酸で自然脱色する。

3. 結果ならびに考察

図1はSDS-電気泳動法をおこなうにあたり最適な試料濃度を知るためのものである。その結果，50μℓが最適試料量と判定したので以下の実験にはこの量を用いた。

図2は生肉と加熱肉（蒸気で10分間加熱処理）との比較である。加熱肉は蛋白質が熱変性し，バンドはほとんど消失した。従って本実験からは除外した。

図3および図4は検体A（取扱い特注品）と検体B（一般市販品）について，冷凍(−18℃)，氷温(−2℃)，冷蔵(5℃）の3温度条件下に放置貯蔵して，3日，5日，7日の経日変化を調べた。検体AおよびBともに−18℃冷凍をコントロールとみなした。その結果，①検体Aの場合は，−2℃氷温貯蔵で3日，5日，7日ともに変化がみられない（蛋白質のサブユニットの変化がみられない）5℃冷蔵貯蔵では3日，5日，7日ともに高分子側では変化がみられな

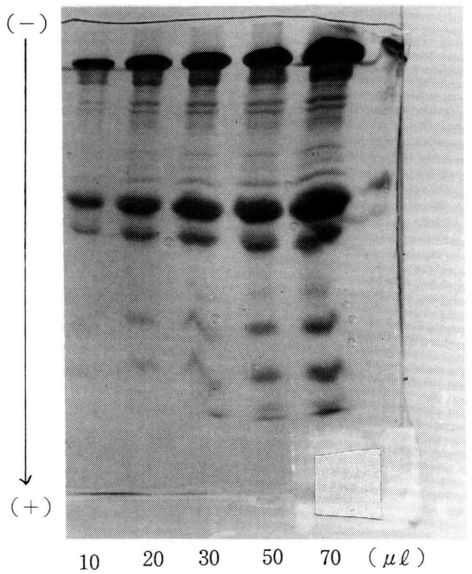

図1　試料濃度の検討

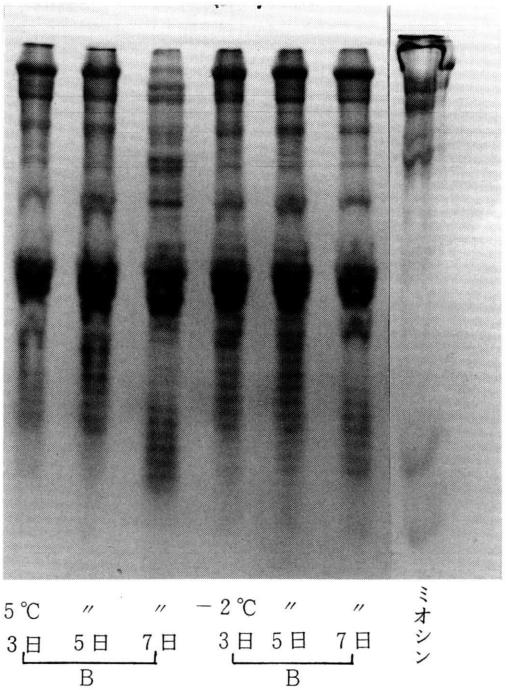

図3　検体Bでの−18℃冷凍，−2℃氷温，5℃冷蔵貯蔵でのタンパク質サブユニットの比較

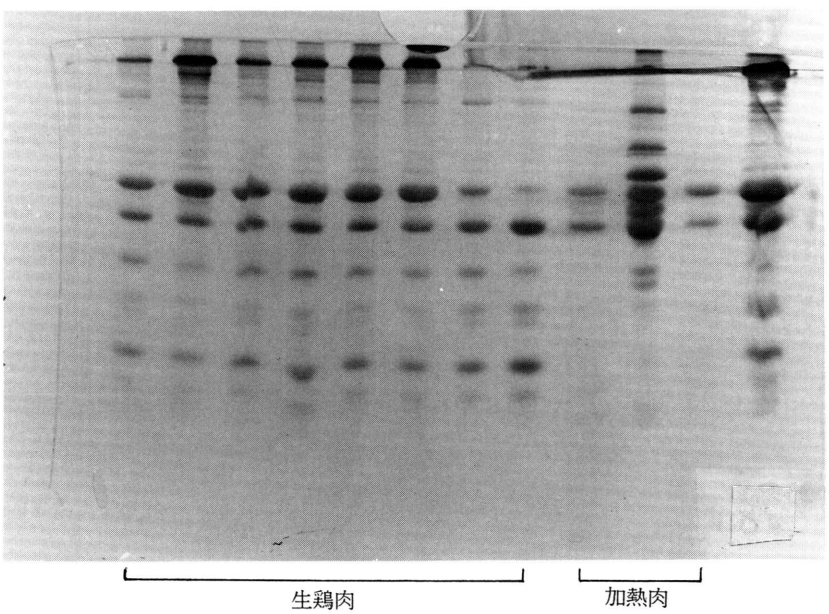

図2　生鶏肉と加熱肉（100℃，10分）とのタンパク質サブユニットの比較

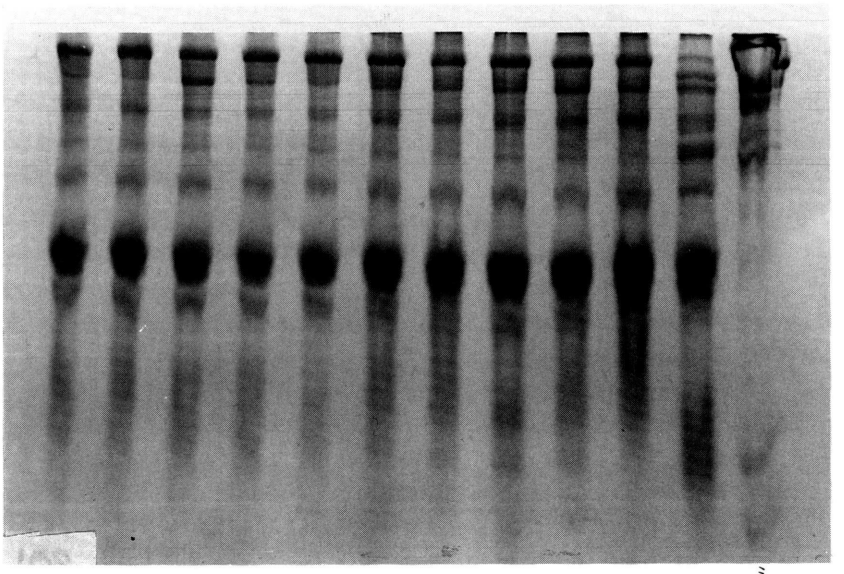

図4　検体Aと検体Bの−18℃冷凍，−2℃氷温，5℃冷蔵貯蔵でのタンパク質サブユニットの比較

いが，低分子側で5日，7日に少し変化がみられる。

② 検体Bの場合は，−2℃氷温貯蔵では，3日，5日，7日ともに高分子側は変化がみられない。しかし，低分子側では7日で，より低分子化へと進んでいる。5℃冷蔵貯蔵では，3日，5日で高分子側に変化がみられないが，7日では著しい変化がみられる。即ち，高分子が分解し，低分子化したのであろう。低分子側は3日から変化がはじまり，7日ではいちじるしく低分子化し蛋白質のサブユニット変化が著しい。

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付　記

検体AおよびBについてのみ述べた。

Studies on Keeping of Freshness and Change of Taste Components (Part 3)

Keisuke HORITSU

(Received on January 30th, 1989)

Introduction

This new medium long storage at the low temperature that the protoplasmic liquid was not frozen was tried with the new procedure. The keeping of the quality was succeeded in the atmosphere that the gas component was exchanged to the inactive gas component (nitrogen gas rich) for the above described storage term at the above described temperature.

From this experimental plan, this process may be suitable to apply to a comparative small scale unit (1 Kg to 0.5 ton), but it may be not suitable to apply to a huge scale unit (1 ton and more).

This new exchange atmosphere storage method was performed with an usage of gas cylinder easily or chemical process at any place.

Also, the cells were kept at a mild living state according to this new procedure. And the quality, especially the eating quality, was kept for two weeks like the fresh state in this preliminary experimental case. This preservation term may be extended up to more easily.

Laboratory of Biology, Main title : Studies on New Preservation and Utilization of Food

Experimental method and Experimental Results

This sample, apple, of agricultural product was selected as one objective material in this case. So, this experiment of apple was one part for this experimental application series of new preservation method. And this experiment made to be one preliminary experiment from one viewpoint, because the storage term could not be extended for the limitation of publication.

After the apples (Fuji) that were selected with relative density classfication were washed, the epidermis was taken out, and cut into halves or quarters according to the experimental object (the cut to eighth was tried.). After the samples were cut to each size, the samples had to be dipped in the physiological solution as fast as possible. And the dipped samples were takes into a thick polyethylene bags that were set in a reduction apparatus. The thickness of polyethylene bag had to be necessary to protect from the leak of gas. After air was reduced sufficiently, carefully, gradually to very slight bubbling, inactive gas was charged successively, naturally, gradually with opening or closing of the valve of the reduction apparatus to 1 atm. Nitrogen gas was supplied from nitrogen cylinder. This supply method was easy and normal. But an inavtive gas could be produced with the following process. Namely the charged gas had to be inactive, so the active gas component had to be removed from the gas (air) that was charged. This tried chemical process was one new absorption treatment that the author tried to the storage experiment for the first time.

This reduced pressure for exchange of gas was nice when about one or two bubbles went out from the surface of sample,

because the moisture content in cells and tissues had to be at physiological level. This range of reduced pressure produced a nice results. After the reduced pressure reached to the objective reduced pressure, instantly the valve of reduction apparatus was opened to charge the inactive gas. But the rate of the charge had to be slowly like the above description.

The removal procedure of the active gas component was performed with a removal in liquid phase that oxygen and carbon dioxide were absorbed with alkaline potassium permanganate solution and alkaline solution of alkali metal hydroxide, [$Ca(OH)_2$, NaOH, and KOH] respectively. And, this application of this removal process was succeeded by the author first. Also, the concentrations of these alkaline solution were 2N to 5N respectively. The charged gas was produced in the process that carbon dioxide and oxygen were absorbed with each aqueous absorption solution in order. And as a final process, the inactive gas that carbon dioxide and oxygen were removed with two kinds of apparatus passed successively through water washing apparatus for control of humidity and for clean of gas. This water washing was very important.

Some typical properties of the representative samples that were selected representatively were showed on the following Table 1.

The pH value of each flesh of each sample was determined with a combination glass electrode pH meter for test tube. And their pH values were in the range of 5.53 to 5.83. Also, the flesh firmness of each sample was determined with a hardness meter. And their firmness of each sample were in the range of 7.51 Kg/cm^2 to 7.70 Kg/cm^2.

The organoleptic tests of acid taste, freshness, juiciness, sweetness, and eating quality were examined for each sample.

The height, diameter, and relative density determinations were determined at the initial time. And the pH value, flesh firmness, and organoleptic test were determined and examined at the initial time, the intermediate time, and the final time respectively.

There were no typical differences in many these pH values and flesh firmness values that were determined at the initial, intermediate, and final times. These values were in the ranges of the above descriptions. Also, there were no typical differences in these organoleptic tested results among the initial, intermediate, and final times. These tested results were nice expected results like pH values and flesh firmness values. The disappearance of differences in these determinations showed the proof that this procedure was suitable to a medium long storage. This experimental storage term had to be two weeks.

Table 1　Typical Properties of the Representative Samples

Height, mm*	70.5	72.3	70.2	71.9	67.7	75.6	71.0	71.0	76.6	76.6
Diameter, mm*	79.1	83.9	80.2	84.3	81.0	84.1	81.1	79.7	79.8	79.3
Relative Density	0.8541	0.8442	0.8395	0.8381	0.8428	0.8483	0.8369	0.8290	0.8374	0.8372

* : Height and diameter were mean value of four positions of each sample.

So, the intermediate time was the first one week. Then, these determinations were performed at three times, inital, intermediate (after one week), and final (after two weeks) times. As another reason, the experiment had to be performed repeatedly. Then the term had to be shortened.

Discussion and Conclusion

The samples, apples, were selected for these storage experiment series that were published previously at the first step. So, the objective samples are possible to exchange into other agricultural products. Then, the pears that were examined partially as the second objective sample in small scale were stored for a medium term at nice state. These successful examined results may be published on other paper. Of course, this new medium long storage of apple in this system was tried to continue more.

This experiment had some objects from several viewpoints. The first object was the possibility of long storage at a living state. The second object was the possibility of application to food product or food industry from a practical point. The third object was the possibility of long keeping of freshness. And the fresh quality had to be held for each objective term. Also, it was the fourth object that this over-all system could be made and operated economically. This point was very important.

There were special techniques that were considered by the author in this process for this medium long storage term. As one of them, there were several reasons in this usage of physiological solution. The first reason : the dipping of the samples was necessary to keep the quality at the stable state against these enzymic reactions during this comparative long process. This new process gave some additive value to the raw samples when they were eaten much conveniently on the eating desk. So, the private pollutions caused with homes in the city may decrease. Then, the process made to be long and complicate slightly. The second reason : this physiological solution gave a mild salted taste to the samples. This taste had to be not strong and not weak. This was nice condition. The third reason : this physiological solution gave a moisture to the samples. This moisture in cells and tissues had to be held in the case of water fruit as the most important property.

Regards to the exchange of gas component to the inactive gaseous atmosphere, this chemical process method was better than the dry method of nitrogen gas charge from gas cylinder in a normal procedure. The moisture content in cells and in tissues was very important factor agains a living state of organism. And this chemical process required some improvements, since the direction of flow of gas was reverse against a normal system. In the first absorption apparatus, the coming gas was countered with the absorption solution in a shower system. In the second absorption apparatus, the nozzle of absorption solution tube had to have many small holes and the absorption part was set on a magnetic stirrer. Namely the ability of absorption and the degree of efficiency had to be large and had to be increased. Then, in each system, there were two kinds of absorption apparatus for each gas at least. And there was the first system for carbon dioxide. And there was the second system for oxygen. Such a system was suitable to take out the produced material, precipitations. Also, the cost of $Ca(OH)_2$ was lower than the others, but the maintenance for NaOH

or KOH was better than $Ca(OH)_2$. However, the cost of KOH was higher than NaOH and $Ca(OH)_2$. NaOH was moderate on the two points.

Nitrogen gas was supplied from gas cylinder. Moreover, a purifed nitrogen gas was on the market, but a little amount of oxygen in nitrogen gas was not necessary to remove for this procedure. The cylinder can prepare easily at town or its near area, but its preparation is not easily at a vally or a country. So, the author considered this chemical process that was possible to perform at any place and time. This chemical process could keep the moisture content at a constant level that nitrogen gas from cylinder could not keep it. And the absorbed material, for example $CaCO_3$, was useful to neutralize the acidity of soil as one of soil improvement agent. Indeed recently, application investigator must consider the second product to protect the pollution. An age changed very much.

When the reduced pressure for remove the active gas component reached to the objective pressure, immediately the charge of the inactive gas component had to be begun as possible as quickly. However, the charge rate had to be slow and gradual much carefully. The long reduced pressure condition below 1 atm. did not produce the nice results. Namely, the cells and tissues had to be living slowly. The complete removal of gas from the cells and tissues had to avoid. Especially the object of this storage experiment was a continuance of state of mild living of organism. If man kept the material for a long time, a freeze method was simple, available and effective. However, the melting technique was very complicate and difficult. In general, after a frozen material was melt, some change appeared. This change was not this object.

If an instrumental analysis of taste was established for apple, the scientific determination might be determined as the substantiation of the organoleptic test. Before the instrument was not established, this organoleptic test was necessary to perform. Because the sample was an eating material. Under such a condition, the organoleptic tests were performed as the above description.

The complete exchanged atmosphere was not suitable to a safe living of a cell, as its cell made to be lived at a mild slow living state. If an all gas was removed absolutely, the living might be not kept completely. So, it was desirable condition that the degree of removal of active gas contained in the cell was kept at such a degree. A complete reduction was most dangerous condition for a living cell. Namely, the limit reduction had to exist at such a condition before the water in cell was evaporated completely, because it was very important that the content degree of water in cell had to be kept at the living state of the cell.

In this case, this experimental storage term could not be extended, because the obtained results had to be concluded until the end of this January. And the experiment had to be repeated again. So, the time of this experiment had to be limited and the term had to be shortened. Moreover, the experiment of this experimental team had to be finished for three years according to the rule of university. And this team had to be disbonded on this March. So. the obtained results had to be published (printed out). So, this manuscription of report had to be presented to the office until this January.

The experiment of agricultural products harvested in autumn was limited many times as this case. Also, the construction of experimental apparatus spent a long time

unexpectedly. Of course, this successful new storage method is trying again for a comparative long storage term. The obtained results may be published on other paper.

The final object of experiment is to keep a living organism at a living state for a long time. Then, it is one think that the final object is constructed with the partial object. So, usually, a living organism lives in the space that is composed with two or three phases. Now, gas and liquid phases are considered. Then, the variables, temperature, volume and pressure, are considered. So, the temperature is held at the lowest temperature that cells are not frozen. The pressure in held at 1 atm. except of some short time of reduced pressure.

Then this new experiment of medium long storage was succeeded in keeping the qualities. Especially, this experiment was performed in exchanged atmosphere at the lower temperature. Moreover, the cell was living at the lower temperature.

Summary

This new medium long storage of agricultural product [for example, apple (Fuji)] was succeeded by the author first at the mild living state of cells according to the exchange of the active gas component to the inactive gas component. The exchange in gas phase was performed with the charge of the inactive gas produced commercially or produced individually after the gas in cells or tissues was least removed under the reduced pressure.

In this individual production case, the inactive gas was the gas components of air that was not absorbed with the alkali metal hydroxide, $Ca(OH)_2$, NaOH, or KOH, and the alkaline potassium permanganate. Namely the samples dipped in physiological solution were set under reduced pressure at first step, successively the inactive gas was charged gradually.

This inactive atmospheric packing method in polyethylene bag was so convenient preservation method that the qualities were kept for a medium long storage term.

This low temperature of storage that the cells lived at the lowest was better than other a little high temperatures. Of course, its effect of exchange of gas under reduced pressure was very much. It was characteristic. A freeze storage was other problem. The object of this experiment was limited to a living state only.

Refernces

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鮮度保持、旨味成分の変動に関する研究（第３報）

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農業生産物［例えばリンゴ（富士）］のこの新しい中程度の長期貯蔵は、活性気体の不活性気体への交換により細胞のおだやかな生きた状態で著者により初めて成功された。気相の交換は細胞や組織にある気体が減圧下で最小限除去された後に、市販によるか個別的製造によった不活性気体の注入によりなされた。　この個別的製造の場合、不活性気体はアルカリ金属水酸化物、$Ca(OH)_2$、KOHおよびアルカリ性過マンガン酸カリウムによって吸収されない空気の気体成分であった。すなわち、生理的溶液に浸漬された試料は第１段階で減圧下におかれ、つづいて不活性気体が除々に注入された。

ポリエチレン袋中の不活性ふんい気包装方法は品質を中程度の長期貯蔵期間中に保持する非常に便利な保蔵方法であった。細胞がぎりぎりで生きている貯蔵のこの低温度は他の極僅かの高温度より良かった。勿論、この減圧下の気体交換の効果は非常に大きかった。これが特徴であった。氷結貯蔵は別問題であった。この実験の目的は生きている状態にだけ限った。