炒炸調理油品變異毒性之調查研究

Monitoring Detection on Mutagenic Activities among Food Preparations during Frying Processes

中文摘要

為了探討市流攤販或炸物餐館回鍋深炸油和油炸食品及一般家用炸炒煮烹調方式所蒸發之油煙中致突變物質的生成，本實驗利用 ISO (International Organization for Standarization) polarity 分離法之萃取流程，分離自攤販餐館採樣之回鍋深炸油共 27 件；繼以 basic extraction 之萃取流程萃取正反應炸油的油炸品共 5 件；而家廚排煙油，則依調理性質：素食，葷食，混合食共 5 件同步分析。並且採用 Ames test，以 *Salmonella typhimurium* TA98 及 TA100 兩種變異型菌株測試方法進行抽離物的變異原性篩檢。

以 TA100 為測試菌株，回鍋深炸油品抽離物不加 S9 時，檢出一家烹調蝦卷快餐店的 non polar 相抽出物、一家臭豆腐綜合料理攤販（各種口味之炸臭豆腐）炸油品的 non polar 相抽出物，其回復突變菌落數有超過溶媒對照組 2 倍以上之正反應；然添加 S9 後，全部油品之抽出物均無正反應。而以 TA98 為測試菌株，不加 S9 時全部油品之抽出物均無正反應，而添加 S9 後則檢出一家炸物自助快餐店（各類炸物：雞腿、豬排、鱈魚、京都排骨）炸油品的三極相抽出物（即 non polar，polar，very polar 三相）、一家炸燒烤攤販（先深鍋油炸後烤）炸油品的 polar 相抽出物，一家鹵炸鴨頭攤販炸油品的 non polar 及 polar 抽出物，一家蝦卷快餐店炸油品的 non polar 及 polar 相抽出物，一家臭豆腐綜合料理攤販（各種口味之炸臭豆腐）炸油品的三極相抽出物（即 non polar、polar、very polar 三相）其回復突變菌落數有超過溶媒對照組 3 倍以上之正反應。以上行檢出品樣劑量反應測驗，皆呈現明顯的劑量效應線性關係。以上各正反應油品的 basic 抽取相分離物的回復突變菌落數均有超過溶媒對照組 3 倍以上的正反應。劑量反應測驗亦皆呈現明顯的劑量效應線性關係。

家廚排煙油樣品分離物對 TA100 及 TA98 變異株的作用，不論添加 S9 與否，素食排煙油之 very polar 相抽出物及葷食排煙油之 polar 相抽出物其回復突變菌落數均有超過溶媒對照組 2 倍以上的正反應混合食排煙油其中一家樣品之 polar 相抽出物，則在 TA98 及添加 S9 下，其回復突變菌落數亦超過溶媒對照組 3 倍以上之正反應。且劑量反應測驗皆呈現明顯的劑量效應線性關係。

本實驗顯示某些攤販餐館回鍋深炸油和其油炸食品及一般家廚排煙油的確含有使 *Salmonella typhimurium* TA98 及 TA100 致突變之成份。作用機轉顯示：回鍋深炸油和其油炸食品的變異毒性均具間接致變（indirect-acting mutagenic）作用，部份亦甚具直接致變（direct-acting mutagrenic）作用。排煙油則大部分皆具有兩種作用機轉。推測所檢出的炸油品制備產物之變異原性主要可能是由油炸品的高溫衍生聚合物所導染的。而排煙油中，除了上述導染的

可能性外，亦似有油熱裂解變性的可能。

英文摘要

ISO (International Organization for Standarization) polar separation and basic extraction and the Ames mutagenicity test were applied to detect mutagens in the 27 sampes of repeatedly used deep-frying fats and 5 deep-fried foods which were sampled from the resturtants and vendors'' stands through Taipei city、Kaohsiung city and Kaohsiung county. Besides, the cooking vapor oils for home use were also sampled from the above places accoding to different cooking ways. The tester strains used were Salmonella typhimurium TA98 and TA100.

The results indicated that 2 deep-frying fat samples from ISO (International Organization for Standarization) polar separation exhibited net revertants more than twofold of solvent controls with S9 mix and no positive responses in comparsion with solvent controls with S9 mix towards the TA100 strain. The positive fat samples (without S9mix) were from: (1)one resturtant of deep-fried shrimp rolls and (2)one vendors'' stand of deep-fried fermented bean-curds. 5 deep-frying fat samples exhibited net revertants more than threefold of solvent controls with S9 mix and no positive responses in comparsion with solvent controls without S9 mix towards the TA98 strain. These positive fat samples (with S9 mix) were from: (1)one resturtant of fried shrimp rolls(2)one vendors'' stand of some kinds of deep-fried fermented bean-curds (3)one resturtant of deep-fried chicken legs (4)one vendors'' stands of barbecued and deep-fried foods (5)one vendors'' stands of deep-fried Dong-Shan duck heads. The most often deep-fried foods from the stores with positive responses were deep-fried fermented gean-curds & shrimp rolls (both towards TA100-without S9 mix and TA98-with S9 mix)、deep-fried chicken legs、barbecued and deep-fried chicken rear and deep-fried Dong-Shan duck heads (only towards TA98-S9 mix), were also all exhibited net revertants more than threefold of solvent controls towards TA100 without S9 mix and with S9 mix towards the TA98 strain.

The vegetarian and meaty cooking vapor oils from ISO (International Organization for STandarization) polar separation both exhibited net revertants more than twofold solvent controls without S9 mix and with S9 mix towards the TA100 and TA98 strains. One of the mixed cooking vapor oil samples exhibited net tevertants more than threefold solvent controls with S9 mix towards the TA98 strain. All the above mutagenic positive samples demonstrsted linear dose-response relationships within the applied doses.

The study demonstrated that some repeatedly used deep-frying fats and fats and foods sampled from resturtants and vendors'' stands contains mutagens, which

are direct-acting mutagenic towards the TA100 strain and indirest-acting mutagenic towards the TA98 strain. The cooking vapor oils for home use are both direct and indirect-acting mutagenic towards the TA100 and TA98 stains.

The mutagenocity of repeatedly used deep-frying fats and foods may be caused by the absorption of derived mutagens onto foods and solutilization into deep-frying fats of some mutagenic pyrosylates and uses. The mutagenicity of cooking vapor oils may be caused by vaporization of some volitate mutagenic pyrosylates which interact with air, especially the cooking gas. The volitate products of lipid oxidation and polymerization may be another one of the unknown causes.