Quality assessment of marketed tea products

Chamomile tea composed of dried flower heads of *Matricaria recutita* L. (Asteraceae) is one of the most popular single ingredient herbal teas. Tea industries, spice shops or public bazaars are mostly supplied with chamomile as a raw material via cultivation or through nature-picking. However, one of the drawbacks of nature-picking is adulteration. Therefore, quality control of raw chamomile materials before marketing should be carefully considered not only by quantification of apigenin 7-*O*-glucoside (A7G, active marker) but also by fingerprinting of chemical composition.

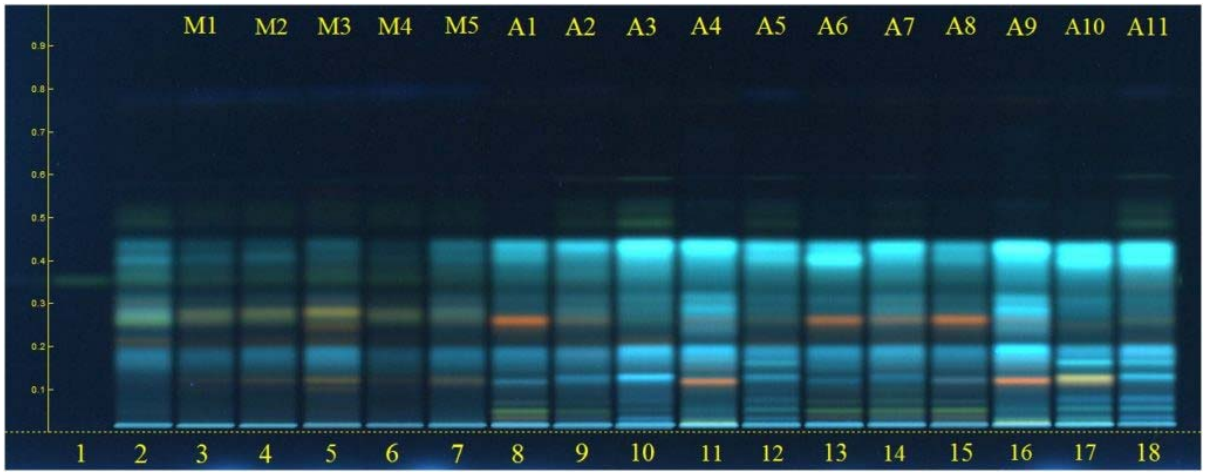

Fig. 1. HPTLC NH2 F254s chromatogram of A7G, chamomile and marketed chamomile tea products at 366 nm. Track 1: A7G (25 ng), Track 2: wild chamomile, Tracks 3-7: M1-5, Tracks 8-18: A1-11; applied sample test solutions: 2 µL/band; derivatization: NP/PEG 400.

This work presents both quantification of A7G and chemical fingerprinting of commercial chamomile tea products (tea bags and crude chamomile flowers) obtained from different food stores and spice shops by a validated HPTLC method. HPTLC chromatogram comparison of marketed chamomile tea products indicated that not chamomile tea bags but crude flowers sold on market were adulterated with other plant materials (Fig. 1). A7G content determined by HPTLC method in different packed tea brands was ranged from 0.43 to 0.80 mg/g, while in most of the crude chamomile samples sold in spice shops, A7G was either not determined or was below the limit of quantification (LOQ), which is 5 ng/band. Eventually, crude flowers sold as chamomile in spice shops would not met with therapeutic expectations of people.

In addition, HPTLC profiles of investigated chamomile tea samples were compared with HPLC method stated in the European Pharmacopoeia (Ph. Eur.). In the Ph. Eur. instead of free A7G content, total A7G amount (including mono- or diacetylated derivatives of A7G) is estimated in hydroalcoholic chamomile extract. Powdered chamomile flowers extracted with ethanol was subjected to HPTLC analysis both directly and following the ester hydrolysis by addition sodium hydroxide reagent to the extract. Acording to the HPTLC chromatogram many components disappeared after addition of sodium hydroxide. In other words, hydrolysis caused to eliminate many

other compounds which may help both to discriminate the genuine specimen and evaluate the possible adulteration. It should be underlined that although A7G is an active marker, it should not be considered as a chemotaxonomic marker for chamomile authentication.

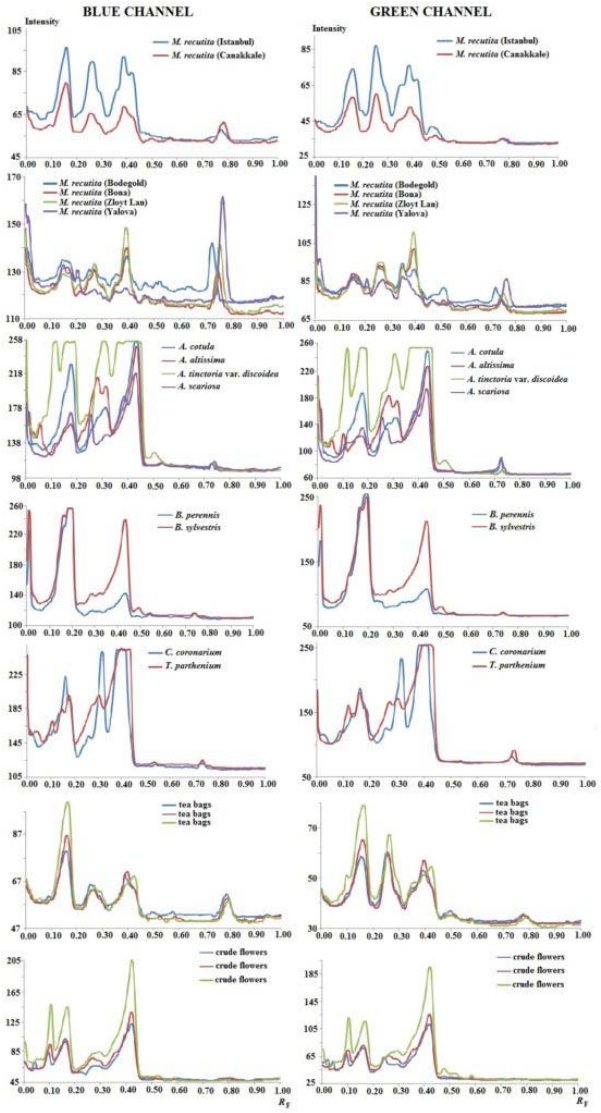

Fig. 2. The line profile plots of HPTLC images for blue and green channels.

In addition, HPTLC fingerprint profiles combined with pattern recognition techniques of these marketed products were comparatively evaluated with wild and cultivar chamomile samples and also chamomile-like species from Asteraceae. Blue and green channels (Fig. 2) showed well separation and provided good discrimination among samples. In order to search for natural groupings among the samples, cluster analysis was applied on data set. According to blue channel, dendrogram shows three main clusters. First cluster consisted of different brands of chamomile tea bags, wild chamomiles, Bodegold and one Bona type cultivars show similar profile. Second cluster consisted of

crude flowers from spice shops grouped with *Anthemis* sp., *Tanacetum* sp. and *Chrysanthemum* sp., indicating their similar chemical profile resulted in either potential adulteration or misidentification. Bona and Zloyt Lan varieties of chamomile cultivars and one cultivar from Yalova formed a third cluster.

In case of green channel, first principal component *PC*1 describes 38.48%, while *PC*2 19.69% of total variability. According to *PC*s score, crude flowers on market were overlapped with *Anthemis* sp., *Tanacetum* sp., and *Chrysanthemum* sp. indicating that probably crude flowers were adulterated with those species from Asteraceae. Chamomile tea bags from different brands were close to wild chamomile samples and *Bellis* sp., except several *Anthemis* spp. which formed separate cluster according to *PC*2. Chamomile cultivars were positioned on the upper right side indicating high dissimilarity from other Asteraceae samples.

Consequently, it is obvious that determination of not only the amount of active ingredient(s) but also ensuring genuine specimen plays a vital role for public health in order to avoid adverse reactions.

Etil Guzelmeric [1], ***Petar Ristivojević*** [2], ***Irena Vovk*** [3], ***Dušanka Milojković-Opsenica*** [4], ***Erdem Yesilada*** [1]

[1]*Yeditepe University, Faculty of Pharmacy, Department of Pharmacognosy and Phytotherapy, Istanbul, Turkey*

[2]*Innovation Centre of Faculty of Chemistry Ltd., Belgrade, Serbia*

[3]*Department of Food Chemistry, National Institute of Chemistry, Ljubljana, Slovenia*

[4]*Faculty of Chemistry, University of Belgrade, Belgrade, Serbia*

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