Studies on surface microstructure characteristics of flue-cured tobacco leaves in different areas of china

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1. Introduction

The appearance quality determination of tobacco leaves is highly dependent on human judgment currently, and looking for objective methods is increasingly a concern. The microstructure of tobacco leaves is the foundation of appearance quality, thus the studies of microstructure of tobacco leaves could provide a reference for quantitative methods of appearance quality analysis. Scanning electron microscopic (SEM) analysis has proved to be a valuable research instrument for studies of the morphology of cells and tissues. Photoshop is one of the essential tools for image processing which has many manipulation methods about selecting areas or features. The related research indicated that Photoshop software had good image recognition and processing functions which could be used in this study. Therefore, SEM and image analysis by Photoshop was used to investigate surface microstructure of flue-cured tobacco leaves in china, and its possible relationship with appearance quality was also explored.

2.Experimental

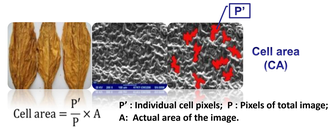
Materials and devices: Flue-cured tobacco leaves of same grade (C3F) from 5 planting areas, 8 provinces in china were collected. The scanning electron microscope of EM3200 was used. A computer installed with Photoshop software CS3 version was used.

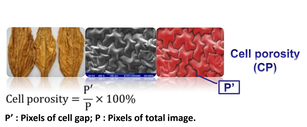
Analysis methods:

SEM image acquisition: 5 leaves every each sample was chosen. 3 visions every leaf on the same position was obtained.

Photoshop software analysis methods: (1) The function of selecting constituents was used; (2) Pixels of each constituent was told by Photoshop.

Calculating Principles: The ratios of pixel of constituents to the total pixel of image was equal to the area percent of those constituents.





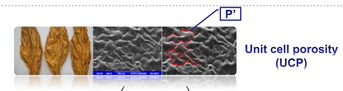


Fig.1 Cell morphology indices and extraction step by Photoshop software

3. Results and discussion

3.1 Cell morphology analysis

Cell apparent morphology (Fig.2): Cells of flue-cured tobacco leaves were irregular in shape and convex in the center which made a fold sense of the individual cell. Compared to other sampling points, central convex and fold sense of cells of leaves from Liaoning province was obviously strong. Fold sense of cells of leaves from Henan province was relatively weak and the majority of cells were flat shape distributed.

Cell area (CA) (Fig.3a): CA of leaves from the Southeast planting area (Guangdong and Fujian province) was relatively large, in which leaves from Guangdong province were significantly larger and about 1.35～1.83 times that of other sampling points.

Cell porosity (CP) (Fig.3b): CP of leaves from the Southeast planting area was relatively small, in which leaves from Guangdong province were significantly smaller and about 0.67～0.81 times that of other sampling points. CP of leaves from the Southwest planting area (Yunnan, Sichuan and Guizhou province) was relatively large,

Unit cell porosity (UCP) (Fig.3c): Similar to CP.

3.2 Cluster analysis of different samples

The cluster analysis indicated that the cell morphology of flue-cured tobacco leaves showed a regular regional distribution, and this distribution law was in accordance with regional characters of flue-cured tobacco appearance put forward recently, in which leaf surface tissue of flue-cured tobacco leaves in the Southwest planting area was considered more exquisite than the Southeast planting area.

3.3 Relationship among cell morphology indices (Fig.4)

Significant positive correlation between CP and UCP was found, showing the trend of these two indices was consistent. Very significant positive correlation between CP and CA was found, indicating CP might be affected by the size of cell. No significant correlation between UCP and CA was found, indicating the UCP was a relative independent index, and could not be affected by the size of cell.

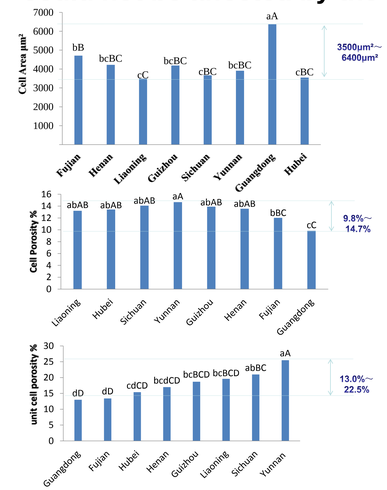


Fig.3 Cell morphology indices of different samples

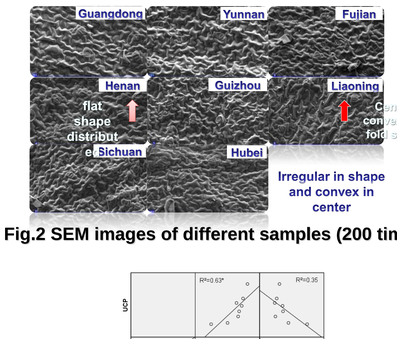


Fig.2 SEM images of different samples (200 times)

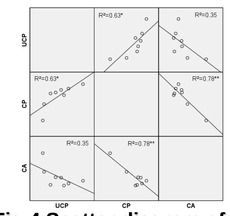


Fig.4 Scatter diagram of cell morphology indices

4. Conclusions

The present method by SEM and Photoshop software facilitated the identification and quantification of cell morphology indices. Cell morphology of flue-cured tobacco leaves showed regional distribution regularity, which was consistent with regional characters of flue-cured tobacco appearance reported before. As a comprehensive and independent index, Unit cell porosity might be an index to evaluate leaf structure of tobacco leaves.

References

1.Zhao, Y.C., et al. (2011) The use of Photoshop software to estimate the adhesion and rust-resistant properties of coating film, Surf. Interface anal., 43,913-917

2.Wang, X.M., et al. (2011) Screening of Regional Characters of Flue-cured Tobacco Appearance from Sensory Evaluating Indicators, Tobacco Science & Technology, (3):59-68