

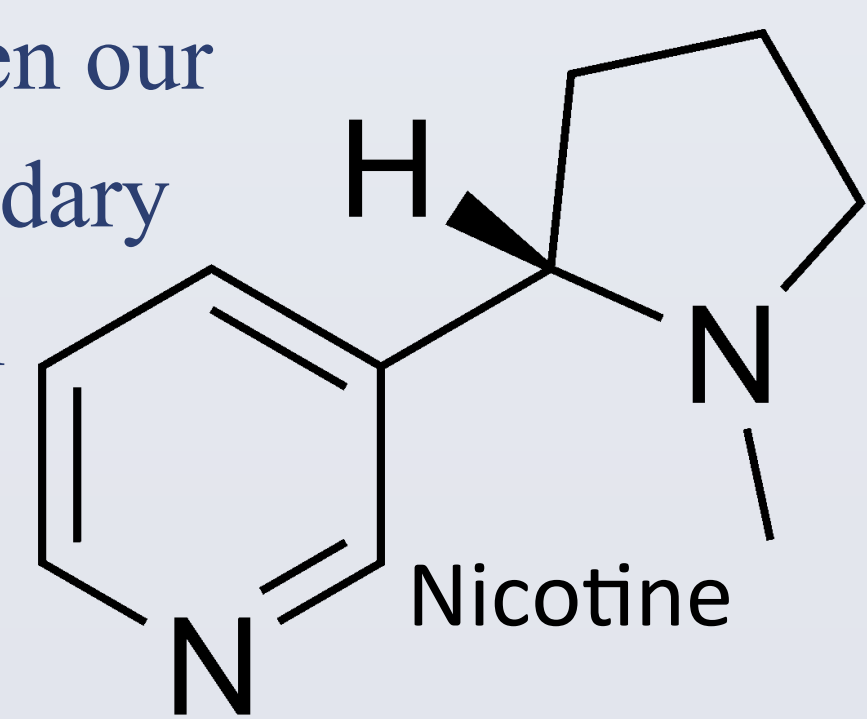
## ABSTRACT

Extraction, purification, and characterization of phytochemicals from plants is an important skill used in studying their medicinal properties. Nicotine, an alkaloid, was extracted with an appropriate solvent, dichloromethane, purified over silica column and then analyzed with IR, UV, and Mass spectroscopy. Nicotine was found to be qualitatively much more concentrated in tobacco from cigarettes than that of the tobacco plant.

## Introduction

Secondary metabolites, such as Nicotine, play important roles in growth and other biological mechanisms. For example, nicotine increases heart rate, blood pressure, and stimulates memory and alertness.<sup>1</sup> Additionally, Nicotine is metabolized into many more metabolites important in a variety of other functions.<sup>3</sup>

It is important to be able to extract such a compound from plants and then characterize it. In this project the primary goal was to extract nicotine from the tobacco plant *Nicotiana tobacum* and a typical brand of cigarettes, and then confirm our results via UV, IR & Mass Spectroscopy. Lastly, tests were done to screen our extracts for other secondary metabolites, in addition to a comparison of concentrations of our alkaloid of interest.



## Objectives

- To screen our extracts for various secondary metabolites
- To determine the best solvent for extraction of the alkaloid nicotine
- To successfully extract metabolites from Tobacco in both *Nicotiana tobacum* & Marlboro Duro cigarettes
- To purify our extracts to obtain only nicotine
- To compare nicotine concentrations from both extracts
- To successfully perform & interpret UV, IR & Mass Spectra for our extracts

## Materials & Methods

### Extraction of Nicotine in Tobacco and Cigarettes

1. First procedure was to acquire the tobacco plant/Cigarettes needed for the experiment
2. Second was to chop up the tobacco plant (this step is not needed for cigarettes) in order to collect 20g
3. Place pieces of plant in 500mL of 70% ethanol
4. Heat up the solution (Not too hot, ~50°C) for 30 minutes then leave out for 18 hours to cool down and concentrate.

### Extraction of compounds from Ethanol tobacco/cigarettes mix

1. 175mL of Ethanol + Plant/ Ethanol + Cigarette with 50mL Hexane 3 times to purify
2. 225mL Ethanol + plant (tobacco)/Cigarette & hexane residue. Purify with CH<sub>2</sub>Cl<sub>2</sub> (Dichloromethane)
3. Lastly keep the aqueous solution from the whole process and then begin the extraction of the nicotine.
  - Individual tests were done to screen for other metabolites.
  - Purification was done over silica gel column.

### Primary Screening of Secondary Metabolites

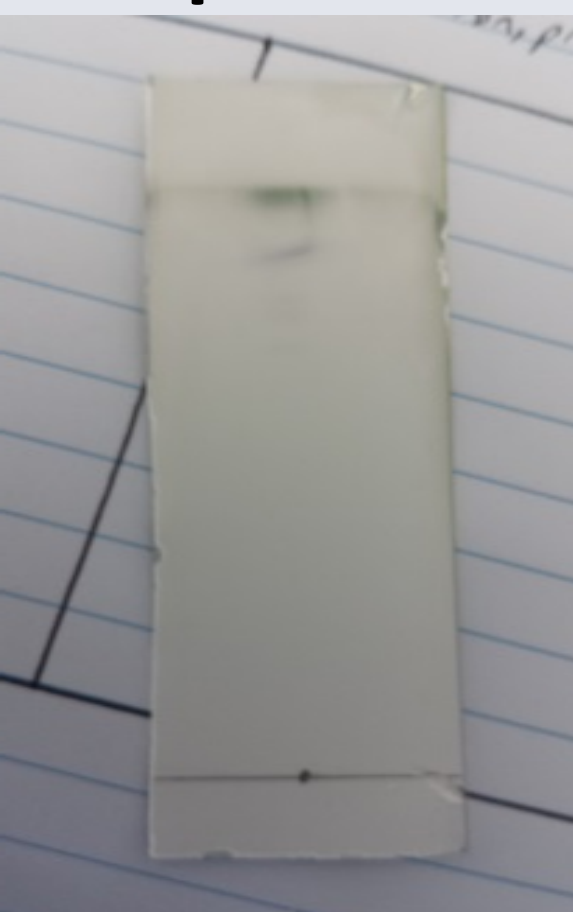
#### Triterpenoids H3



#### Alkaloid H6



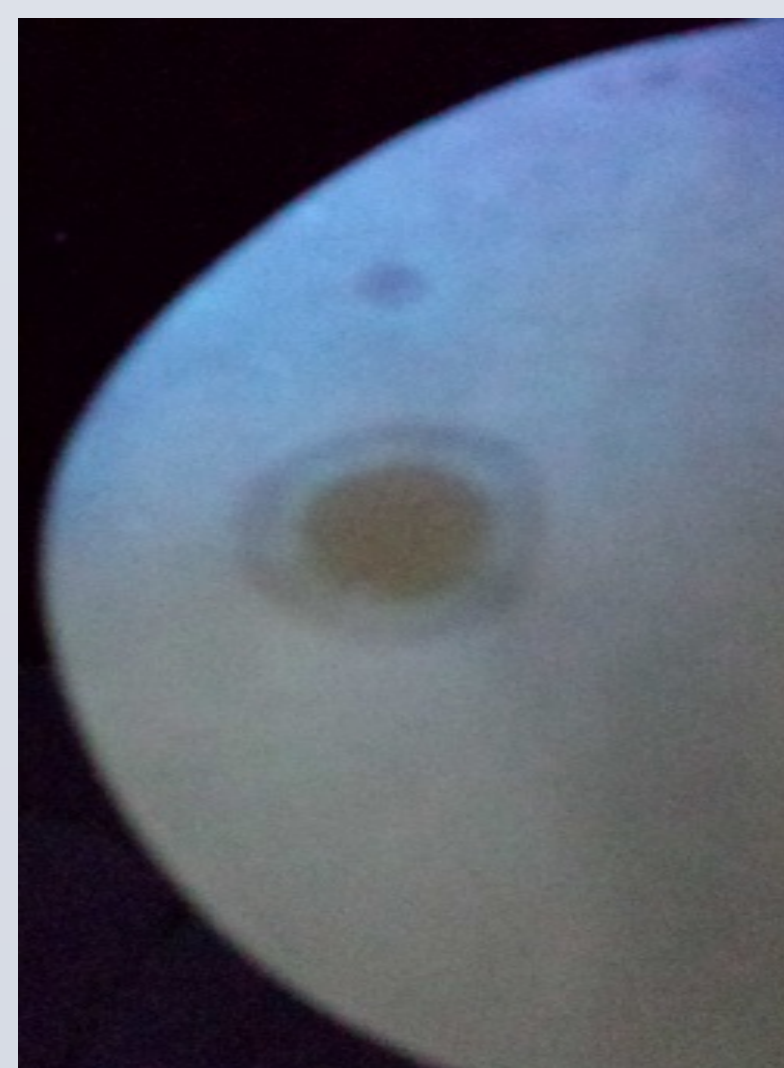
#### Terpenes H2



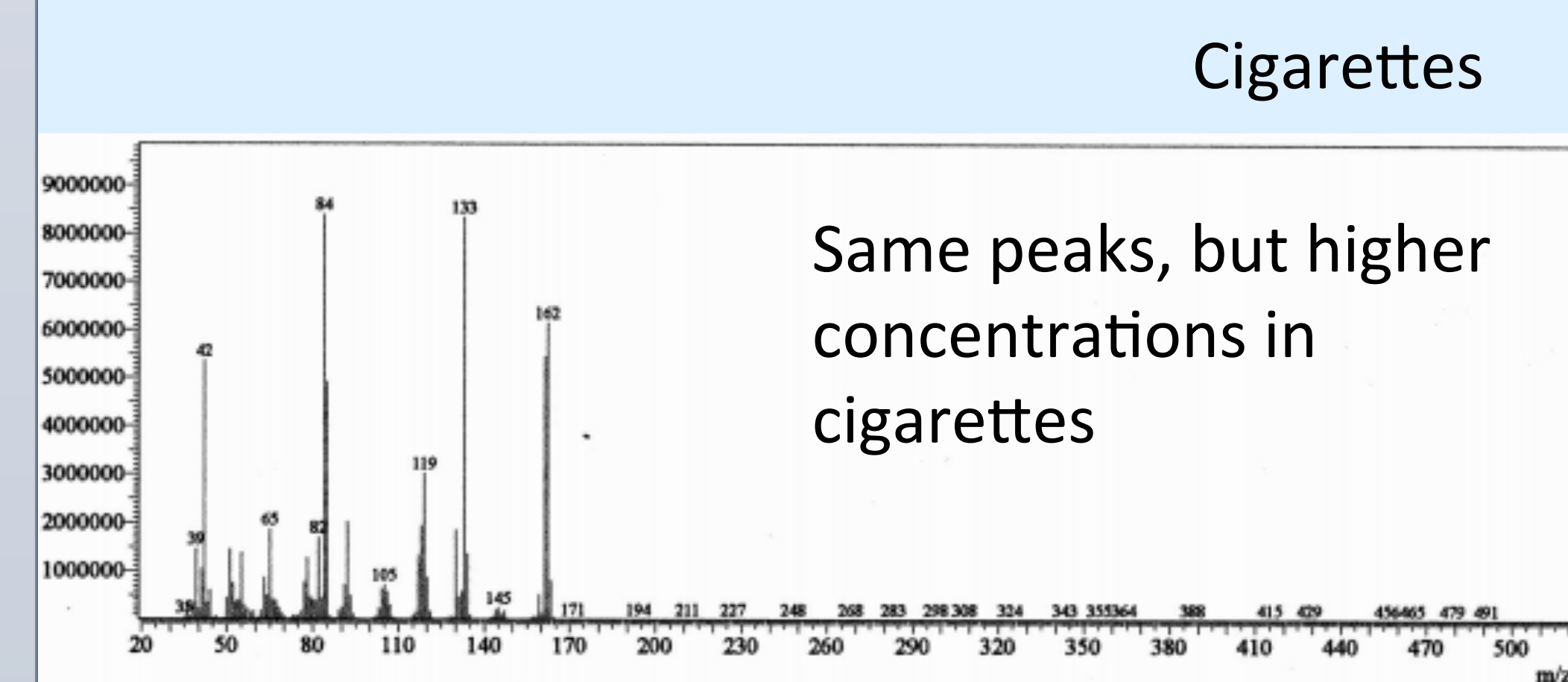
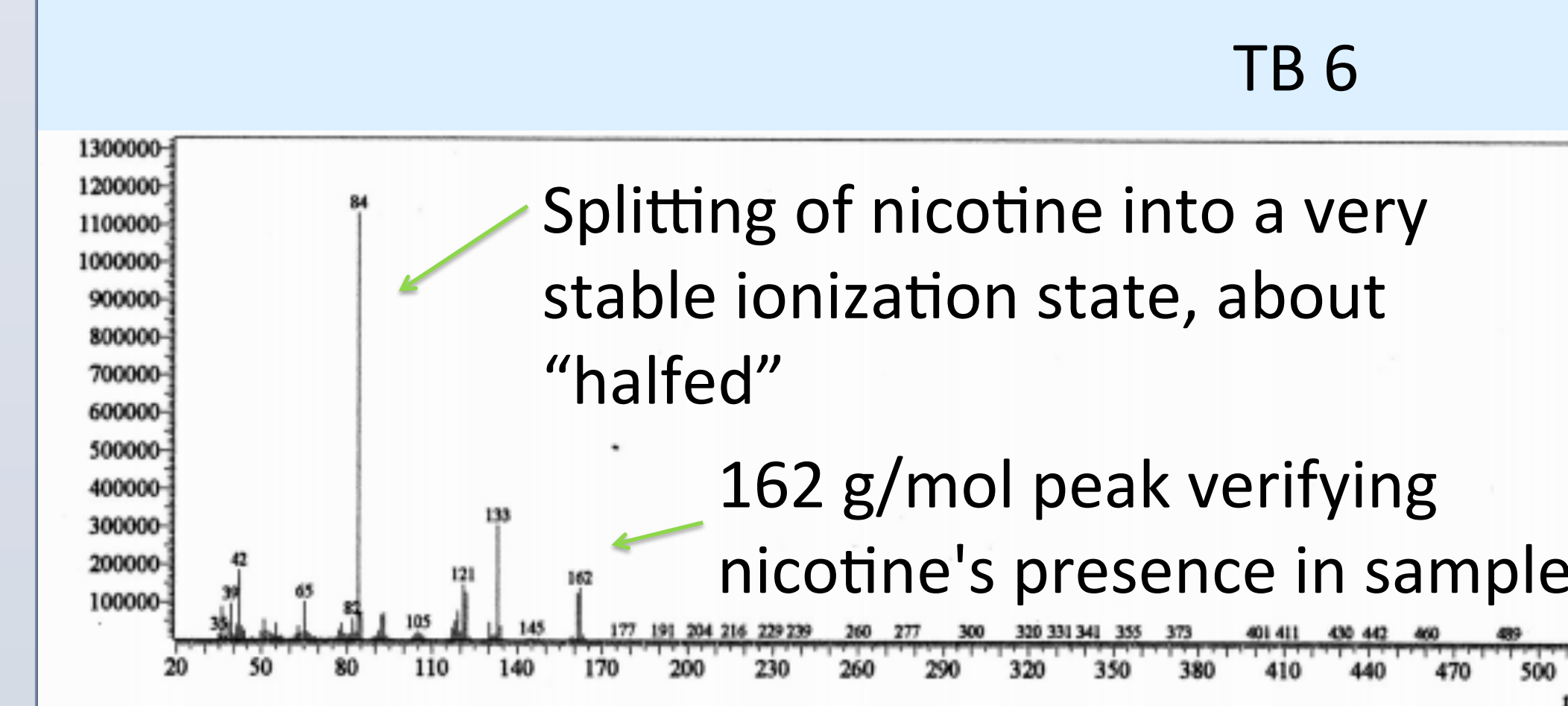
#### Dragendorff DCM



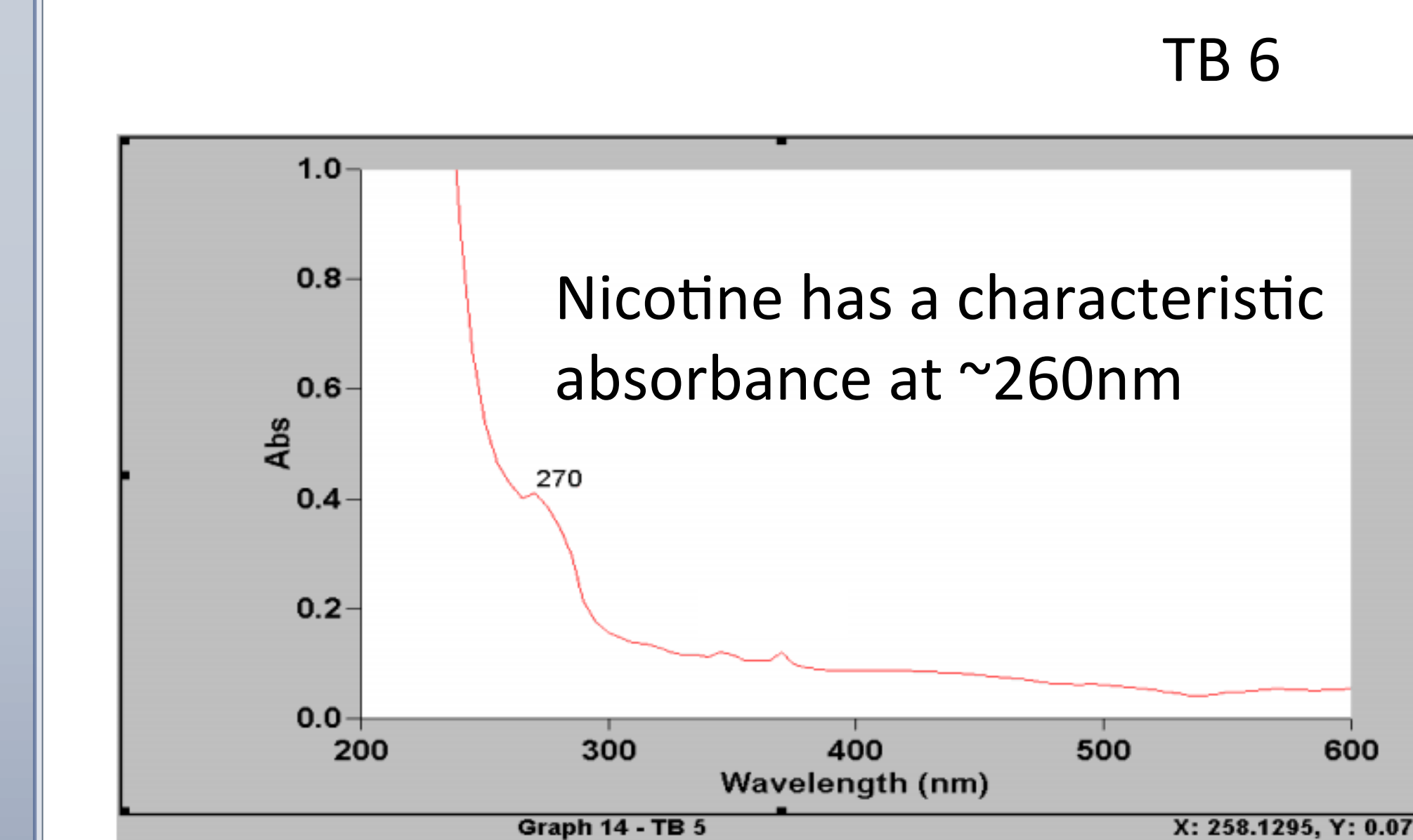
#### Coumarins H4



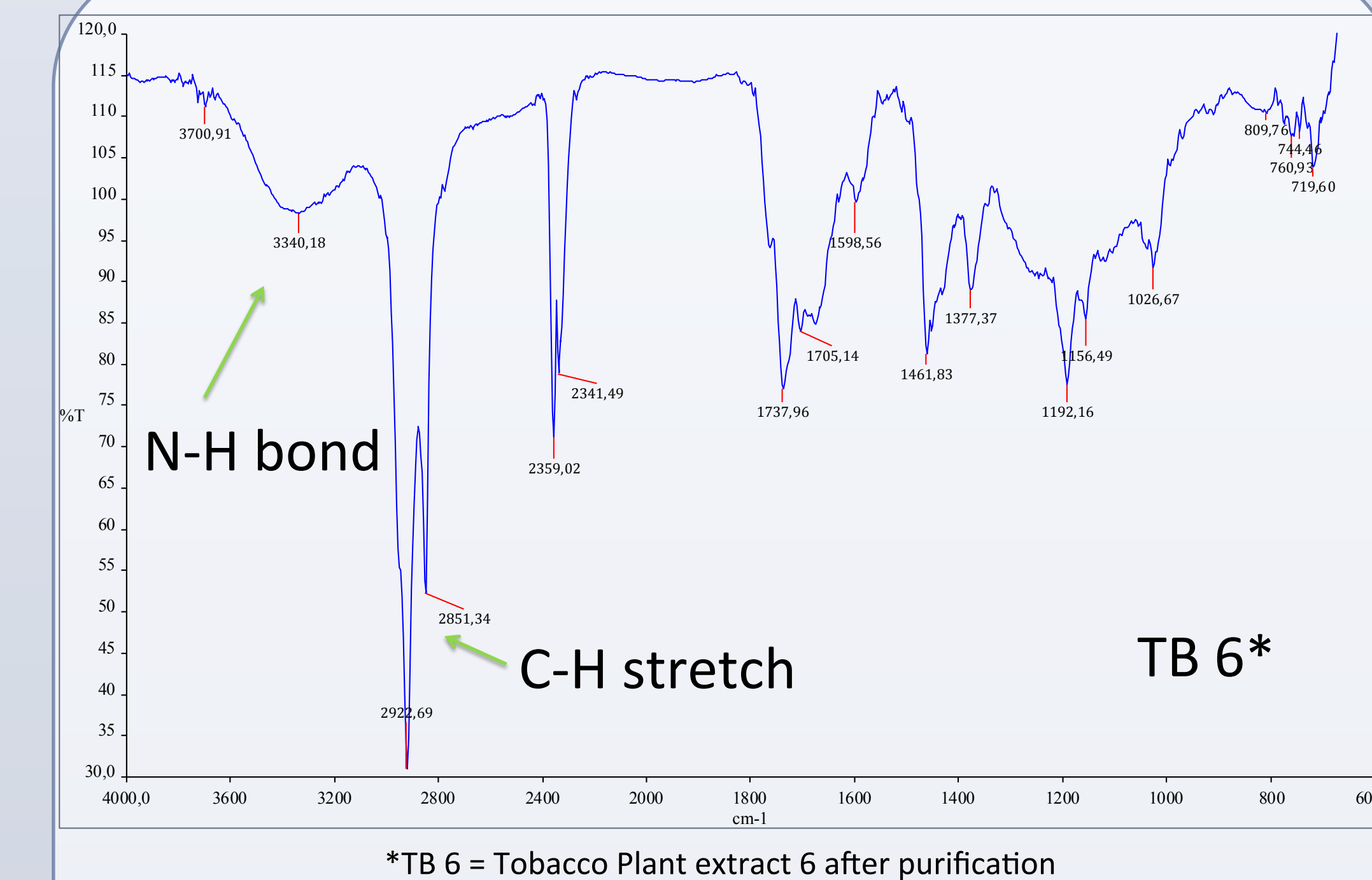
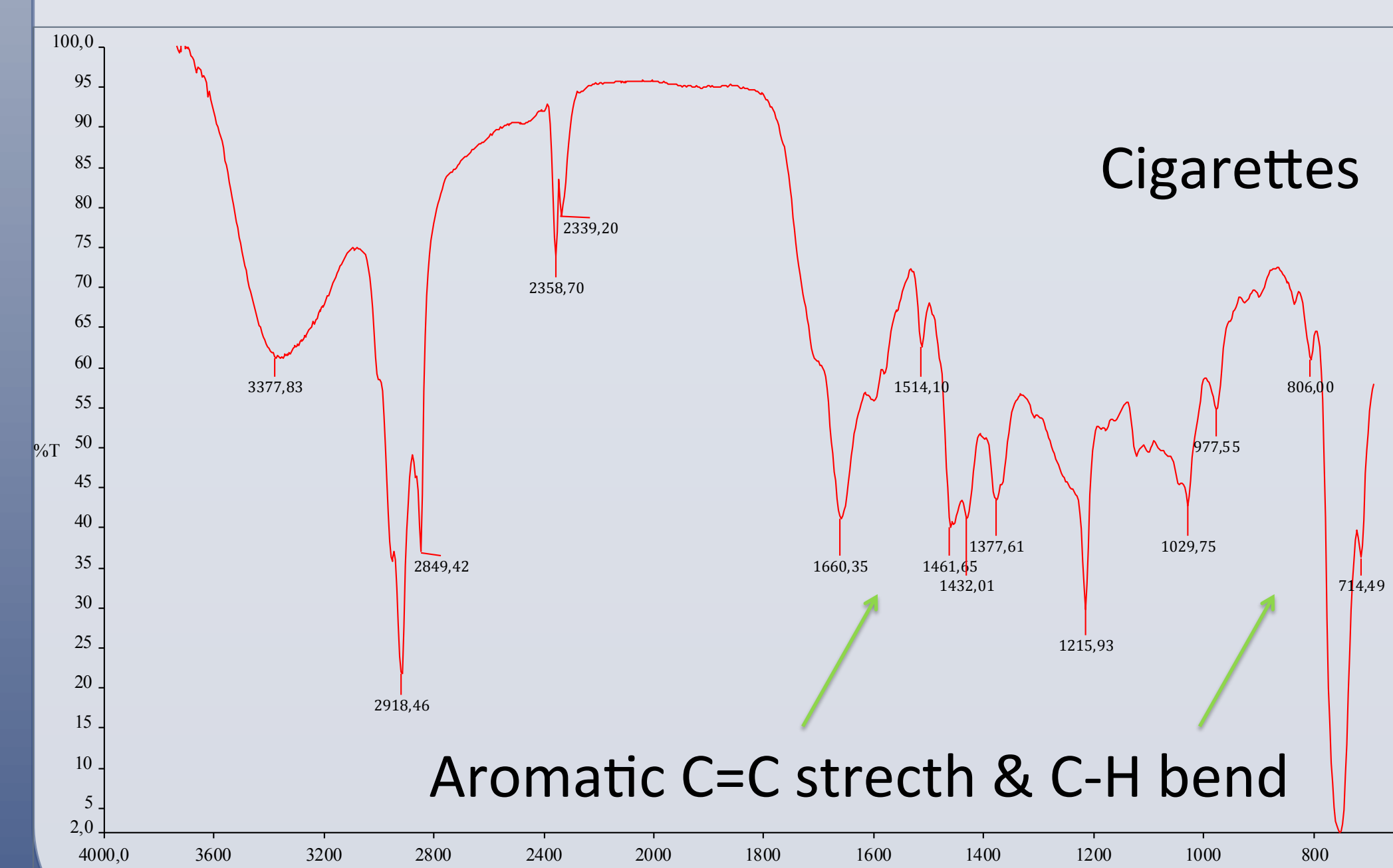
## Mass Spectra Results



## UV Spectra



## IR Spectra



\*TB 6 = Tobacco Plant extract 6 after purification

## Conclusions

1. After following extraction protocols, nicotine was successfully extracted from Tobacco leave samples, which was then verified by UV, IR & Mass Spectroscopy.
2. Dichloromethane was determined to be the best solvent for extraction due to its nonpolar nature.
3. A list was compiled of other metabolites present in the extracts.
4. The dichloromethane extract was purified over silica gel.
5. Purification quality of the products was determined by gas chromatography; showing us that our tobacco plant purification could be improved.
6. **\*Nicotine concentration in Cigarettes was found to be much higher than that of Tobacco leaves. However, more testing must be done to get definitive numbers.**

## References

1. George TP. Nicotine and tobacco. In: Goldman L, Schafer AI, eds. *Cecil Medicine*. 24th ed. Philadelphia, PA: Saunders Elsevier; 2011:chap 31.
2. National Institute of Standards and Technology; IR & Mass Spectra; RN 54-11-5; <http://webbook.nist.gov/cgi/cbook.cgi?ID=C54115&Units=SI&Mask=680>
3. USA. U.S. National Institutes of Health. National Cancer Institute. *Smoking and Tobacco Control Monograph No. 9*. By Dietrich Hoffmann and Ilse Hoffmann. N.p.: n.p., n.d. Print. ???

## Acknowledgments/Contacts

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Questions can be sent to: [tlageman1@binghamton.edu](mailto:tlageman1@binghamton.edu) or [mrbelo92@aol.com](mailto:mrbelo92@aol.com)