



University of Turin,  
Department of Chemistry



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# Investigation on paint thinners quality: development of analytical methods for determination of composition and metal content

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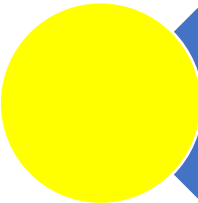
# Paint Thinners

A **paint thinner** is a solvent or a mixture of solvents that find many uses in industrial and domestic fields. Commercially, solvents labeled "paint thinner" are usually **organic volatile and semi-volatile compounds**.

*Acetone, white spirit (aqua regia), Naphtha, Nitro, Turpentine, etc..*



Technical (pure)



Regenerated (recovered by exhausted)



Exhausted (Waste product)

**Exhausted** paint thinners could be **regenerated** and used in some industrial processes to **lower the costs**.

**Regenerated** or even **exhausted** paint thinners could be sold as **technical** ones, leading to a **commercial fraud**.

# Aim of the project

Develop analytical procedure to distinguish among **technical**, **regenerated** and **exhausted** paint thinners.

## Determinate Quality!

3 stages of analysis were conducted, on commercial samples (supposed to be technical) and certified samples of each category for comparison

**Metal  
Content**

**Dry  
Residue**

**Organic  
Composition**

# Analytical Procedures

## Metal Content

2 sample preparation approaches

- Strong acid attack on dry residue
- Incineration



Analysis in:

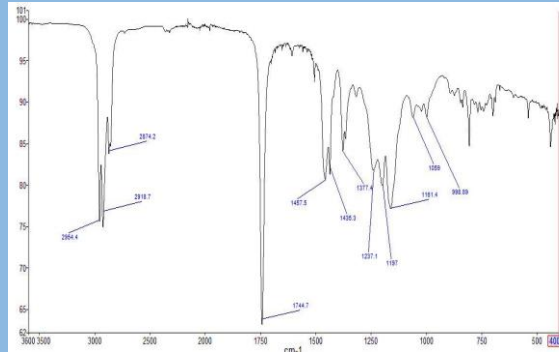
- ICP-OES
- HGAAS

## Dry Residue

- Gravimetric analysis (quantitative)



- IR spectra in ATR (qualitative)

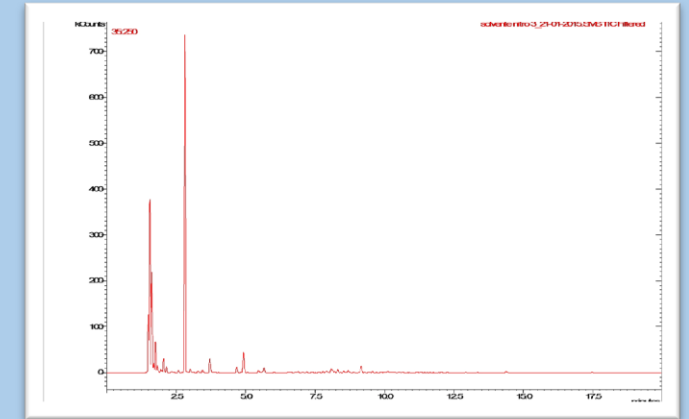


## Organic Composition

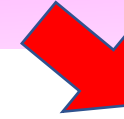
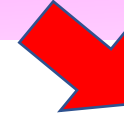
GC- MS analysis

3 different injection methods:

- Direct full injection
- Wet needle
- Head space




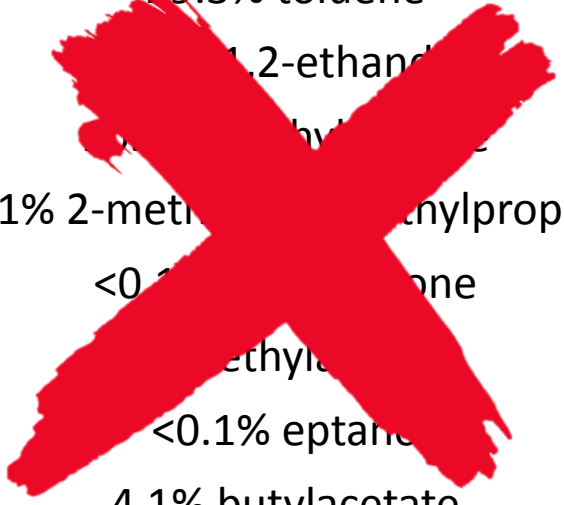


# Metal Content



Sample ID
Type
Elements
Al
As
Ba
Ca
Cd
Cr
Cu
Fe
Hg
K
Mg
Mn
Na
Ni
Pb
Zn

# Organic Composition - References

	THECNICAL GRADE THINNERS		EXAUSTED AND REGENERATED THINNERS	
	Acetone	Nitro 480	Regenerated	Exhausted
<b>Experimental analysis</b>	100% acetone 	<div style="border: 2px solid green; padding: 5px;">                     &lt;0.1% methanol                      33.3% ethylacetate                      66.7% toluene                 </div> 	<div style="border: 2px solid green; padding: 5px; margin-bottom: 5px;">                     &gt;99.9% acetone                 </div> <0.1% dichlorometane <0.1% ethylacetate <0.1% toluene <0.1% butylacetate 	50.6% acetone 29.3% toluene 12-ethandiol ethylacetate <0.1% 2-methylbutylpropane <0.1% acetone ethylacetate <0.1% eptane 4,1% butylacetate <0.1% aromatic hydrocarbons 
<b>As declared on the label</b>	acetone	<div style="border: 2px solid blue; padding: 5px;">                     methanol                      etihylacetate                      toluene                 </div>	<b>NO LABEL</b>	<b>NO LABEL</b>

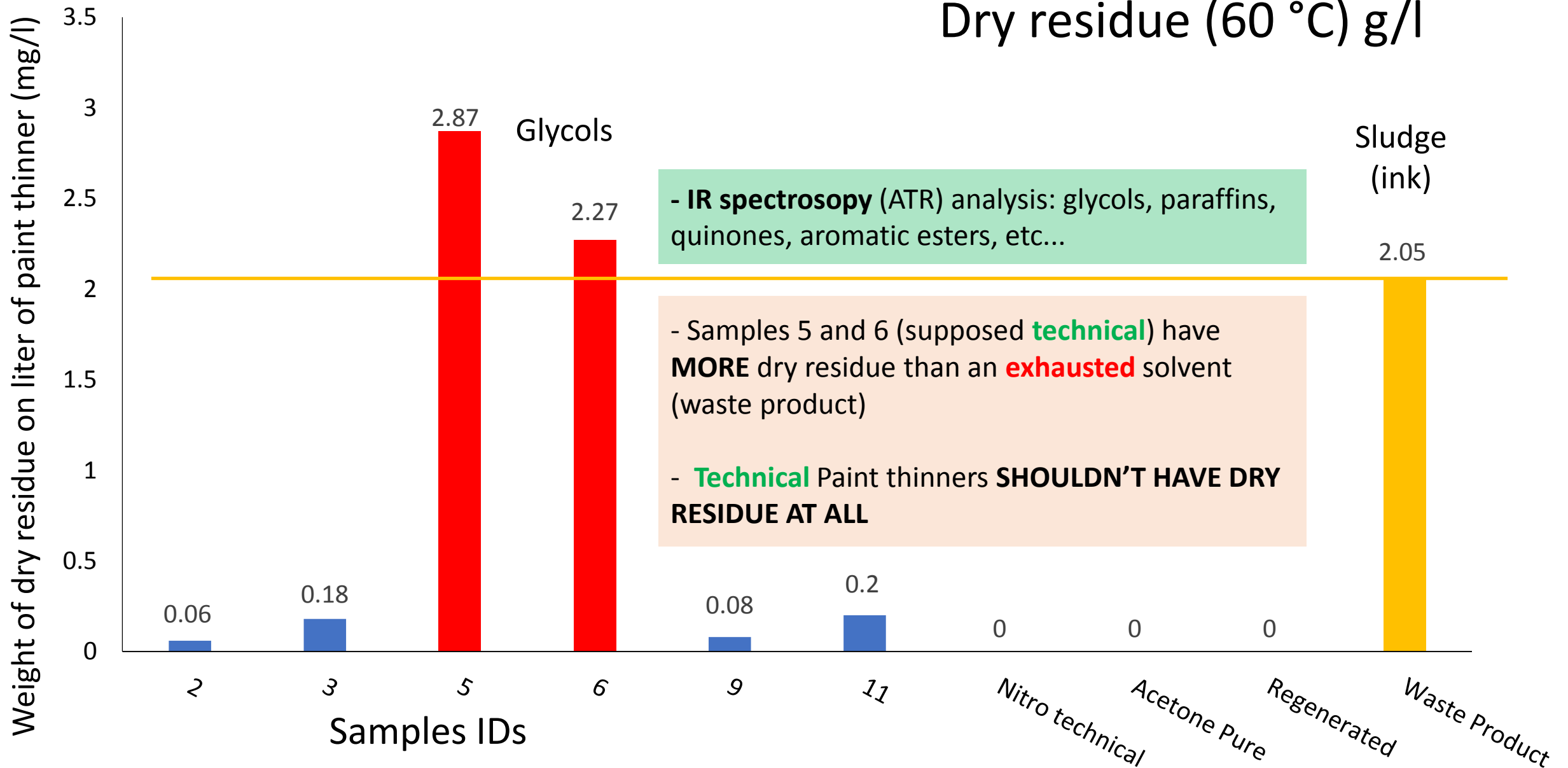


# Organic Composition - Samples

	COMMERCIAL PRODUCTS		
	Nitro 3	Nitro 5	Nitro 9
<b>Experimental analysis</b>	<p>&gt;99.9% toluene ✓</p> <p>&lt;0.1% methanol</p> <p>&lt;0.1% acetone</p> <p>&lt;0.1% methylacetate</p> <p>&lt;0.1% hydrocarbors C7-C13</p> <p>&lt;0.1% ethylacetate</p> <p>&lt;0.1% THF</p> <p>&lt;0.1% butylacetate</p> <p>&lt;0.1% tetrachloroethylene</p> <p>&lt;0.1% aromatic hydrocarbons</p>	<p>6.3% toluene</p> <p>19.8% isopropanol</p> <p>31.9% ethylacetate</p> <p>0.4% methanol</p> <p>5% methylacetate</p> <p>0.5% 2-butanol</p> <p>1.0% esane</p> <p>3% MIBK</p> <p>1.5% butylacetate</p> <p>24.9% aromatic hydrocarbons</p> <p>5.7% 2-ethyl-1-esanol</p> <p><b>42%</b></p>	<p>7.9% toluene</p> <p>28.6% methylacetate</p> <p>0.4% methanol</p> <p>4.5% acetone</p> <p>0.8% MEK</p> <p>12.8% etihylacetate</p> <p>1.6% THF</p> <p>25.4% hydrocarbors C7-C13</p> <p>0.2% MIBK</p> <p>4.4% butylacetate</p> <p>12.6% aromatic hydrocarbons</p> <p>0.2% indane</p> <p><b>63%</b></p>
<b>As declared on the label</b>	<p>toluene</p>	<p>toluene</p> <p>isopropanol</p> <p>ethylacetate</p>	<p>toluene</p> <p>methylacetate</p> <p>methanol</p>

# Dry Residue

Dry residue (60 °C) g/l





# Conclusions

Analytical processes showed that **every one of the three stages of analysis are fundamental** to understand the quality and the properties of the paint thinners. In fact, they are very much **complementary** and for each one of them is possible to **trace quality standards**.

The commercial paint thinners characteristics, as showed by the analysis, are comparable, for the most of them, to **regenerated solvents**. The very few of them shows characteristics near to **technical** ones.

Law describes that **only technical grade solvent could be sold public** (D. Lgs n. 152/2006 “Norme in materia ambientale”, Titolo IV, Capo I) because of health and security related matters.

**Samples examined lead us to a legit doubt about an on going commercial fraud.**



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# THANK YOU FOR YOUR ATTENTION!

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*Rimini, 19<sup>th</sup> November 2018*

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