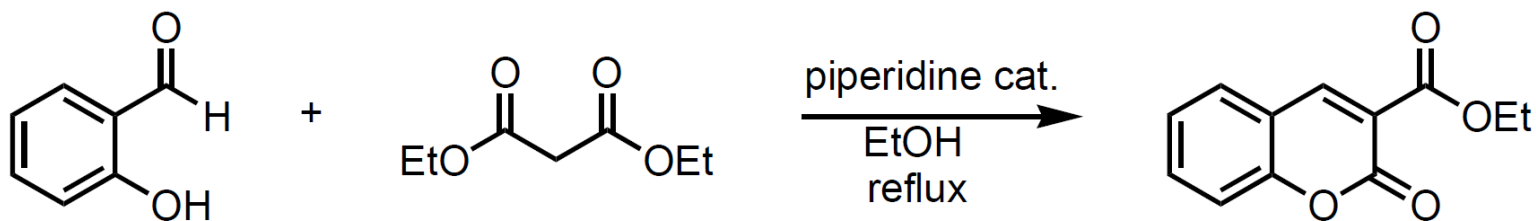


Experiment 4:

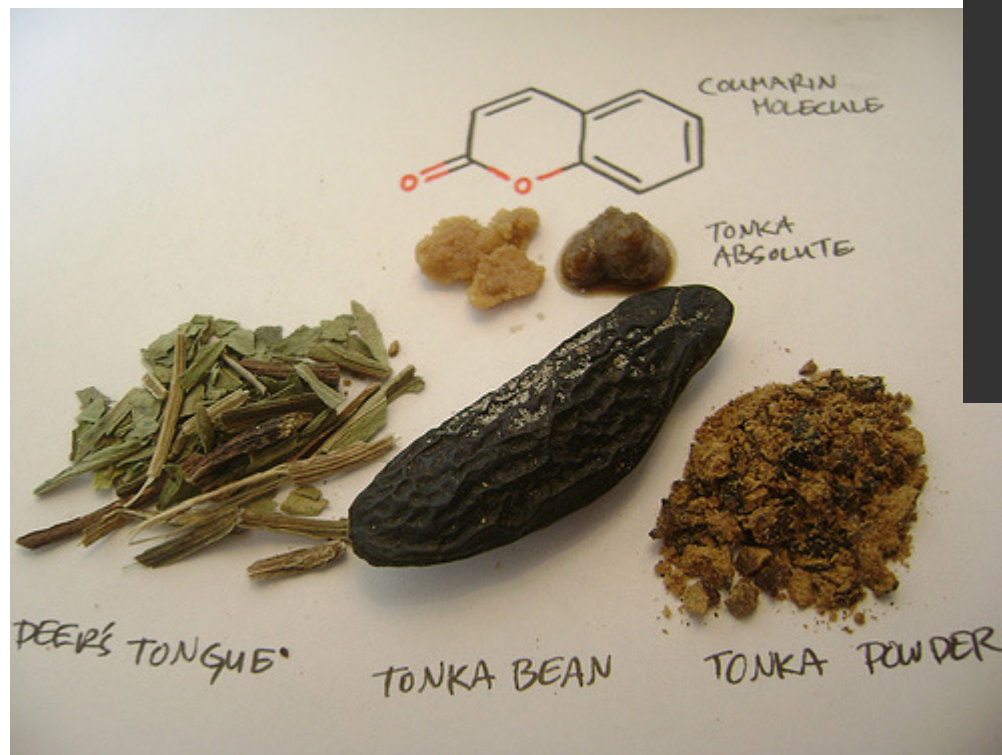
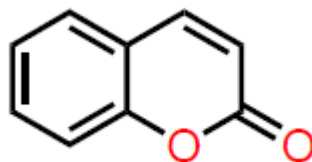
Synthesis of coumarins, Knoevenagel condensation



- Synthesis of coumarins
- Chemistry of enolates: Knoevenagel condensation
- Techniques: reflux, cristallization
- Manipulation of toxic substances

Coumarins

- Found in many plants



Coumarins

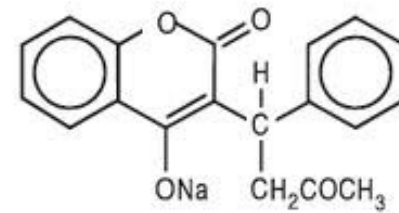
- Perfums



Among the most popular ingredients in perfumes coumarin takes pride of place being included in almost 90% of all perfumes! The pliability and versatility of this fragrance note is legendary, accounting for a sweet and fresh facet that rises up from the bottom onto the heart of the fragrance, lingering on the skin for hours and enriching a perfume composition via its scent magic.

Coumarins

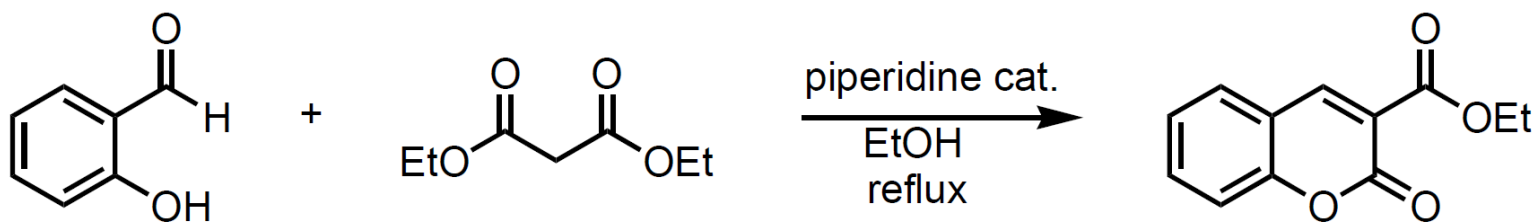
- Anticoagulants



Warfarin sodium



Experiment 5: Synthesis of coumarins, Knoevenagel condensation

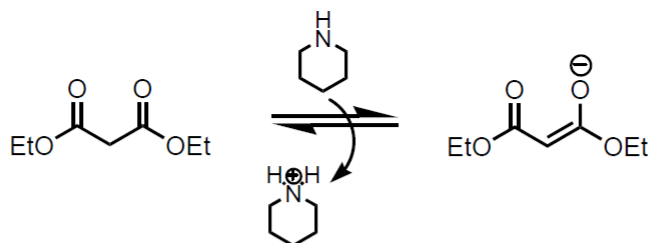


- Knoevenagel condensation + intramolecular transesterification
- **Knoevenagel condensation:** similar to the aldol reaction but now the nucleophile is the enolate of a compound with activated methylene protons

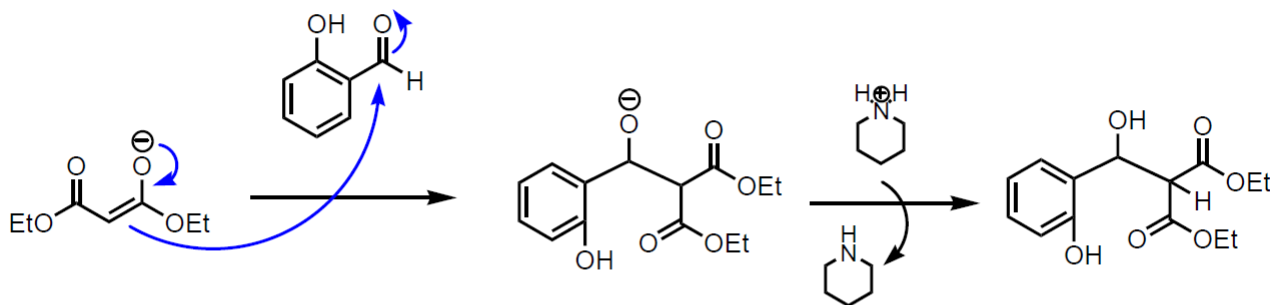
Knoevenagel condensation

Heinrich Emil Albert Knoevenagel
(18 June 1865 – 11 August 1921)

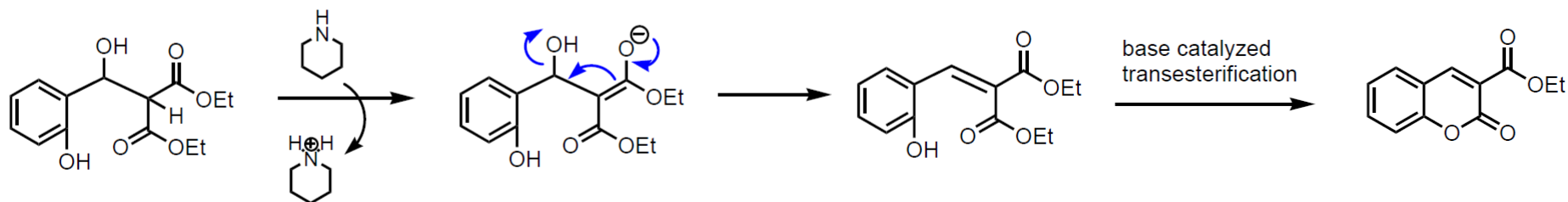
Knoevenagel, E. Condensation von Malonsäure mit Aromatischen Aldehyden durch Ammoniak und Amine. *Ber. Dtsch. Chem. Ges.* **1898**, 31, 2596-2619.



Enolate formation



Addition



Experiment 5:

Synthesis of coumarin, Knoevenagel condensation

Aldeide salicilica	 
Dietil malonate	
Etanolo	
Piperidina	  
Cloruro di metilene	
3-carboetossi cumarina	