

# **Pollutants of Emerging Concern in Asian Megacities such as Karachi**

**HEINRICH HÜHNERFUSS<sup>1\*</sup>, MARKUS SCHEURELL<sup>1</sup>, RAZA M. SHAH<sup>2</sup>**

**<sup>1</sup>Institute of Organic Chemistry, University of Hamburg, Martin-Luther-King-Pl. 6,  
20146 Hamburg, Germany**

**<sup>2</sup>HEJ Research Institute of Chemistry, University of Karachi, Karachi, Pakistan**

- 1. Concept of the Study**
- 2. Experimental**
- 3. Results**
- 4. Conclusion**

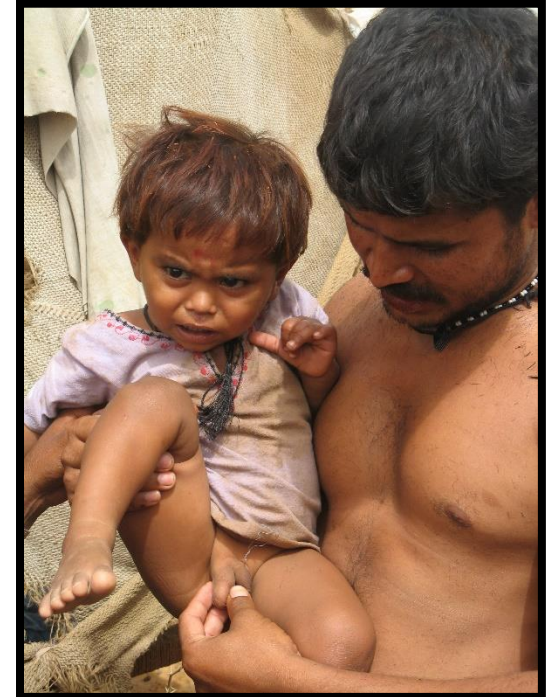


***Karachi:***

**Landhi town, a large industrial town in the eastern part of *Karachi*: dramatic poisoning of about 200 children in Sept. 2005 due to drinking water contamination**

***Karachi:***

**The helpless mother of a two-year-old boy despairingly watches her son loose his grip on life. There is nothing the doctors can do to lessen her grief. As the hospital staff turn their focus on the next emergency, the death of the two-year-old becomes just another number added to the death toll due to the water contamination crisis in Landhi.**



## The mutagenic potentials of tap water samples in Shanghai

Lei Shen <sup>a</sup>, Jian-Yong Wu <sup>a</sup>, Guo-Fang Lin <sup>a</sup>, Jian-Hua Shen <sup>a,\*</sup>,  
Johannes Westendorf <sup>b</sup>, Heinrich Huehnerfuss <sup>c</sup>

<sup>a</sup> *Institute of Plant Physiology and Ecology, Shanghai Institutes for Biological Sciences, Chinese Academy of Sciences,  
225 Chongqing Road (S.), Shanghai 200025, China*

<sup>b</sup> *Institute of Toxicology and Environmental Medicine, Medical School, University Hamburg, 22527 Hamburg, Germany*

<sup>c</sup> *Institute of Organic Chemistry, University Hamburg, 20146 Hamburg, Germany*

# 1. Concept of our Study

## Final goal

**Analysis of potential Water Resources for clean Drinking Water in Megacities in third world countries**

**Based on these results development of strategies for cleaning natural water resources**

**In this presentation I will confine myself to the outcome of the analytical part of this study carried out in Karachi and in Sindh/Belutschistan, the southern counties of Pakistan**

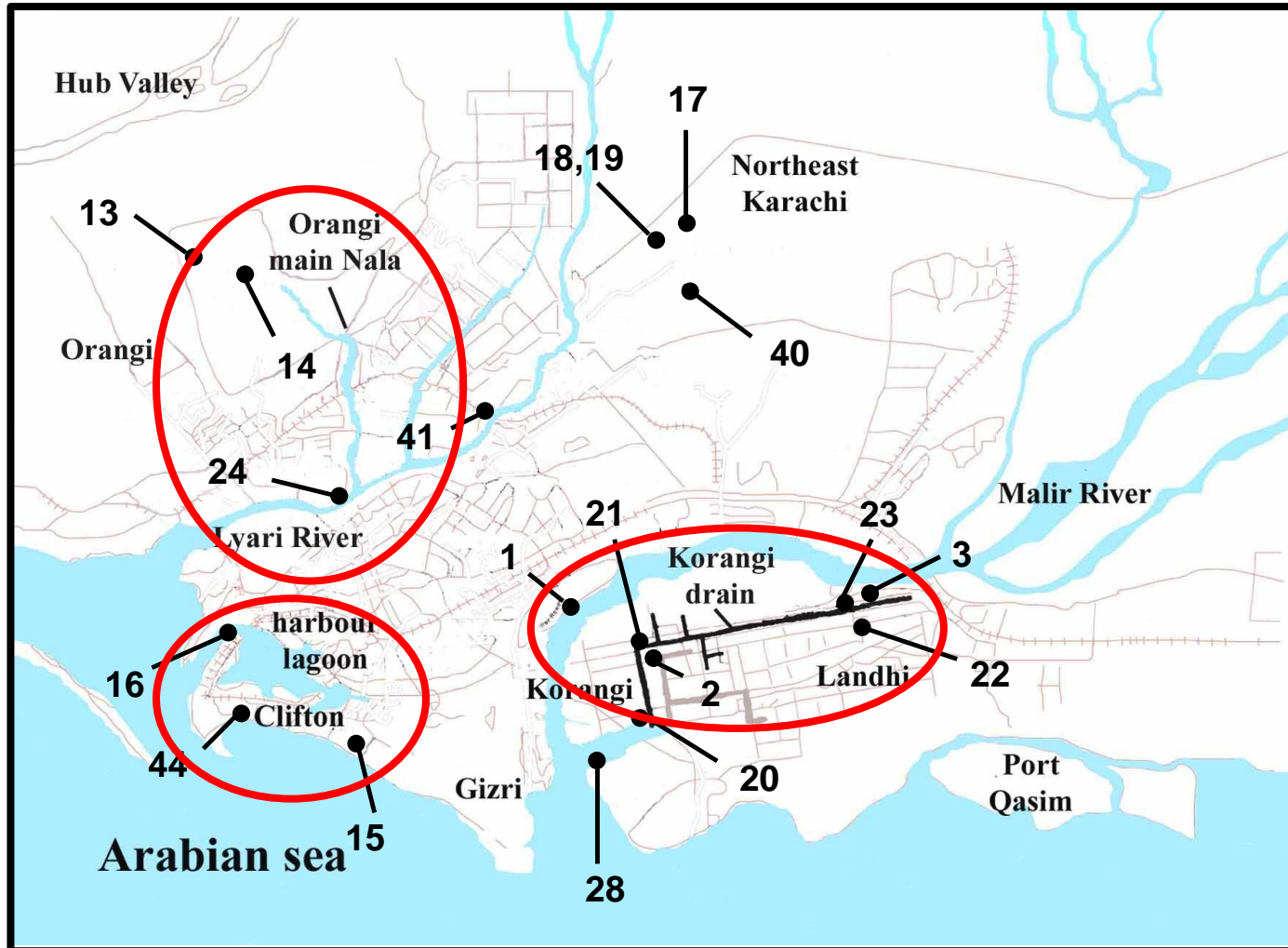


A.) Sampling Area:

Karachi  
Sindh  
Baluchistan

## A.) Sampling area and Strategy

Map of Karachi showing the rivers and the draining system, sampling locations are marked (●)



Sample 1: Malir River

Sample 2: Tube Water Clifton

Sample 3 in the mangrove lagoon, part of Karachi harbor

Samples 4, 5, 6 and 8 from an open drainage canal system (Korangi drain)



**The analyses included different potential water resources as follows:**



**Landhi Pollution Area**



**Malir River**



**Korangi Drain Canals**



**Orangi Awami Tank**



**Tube in a Factory**

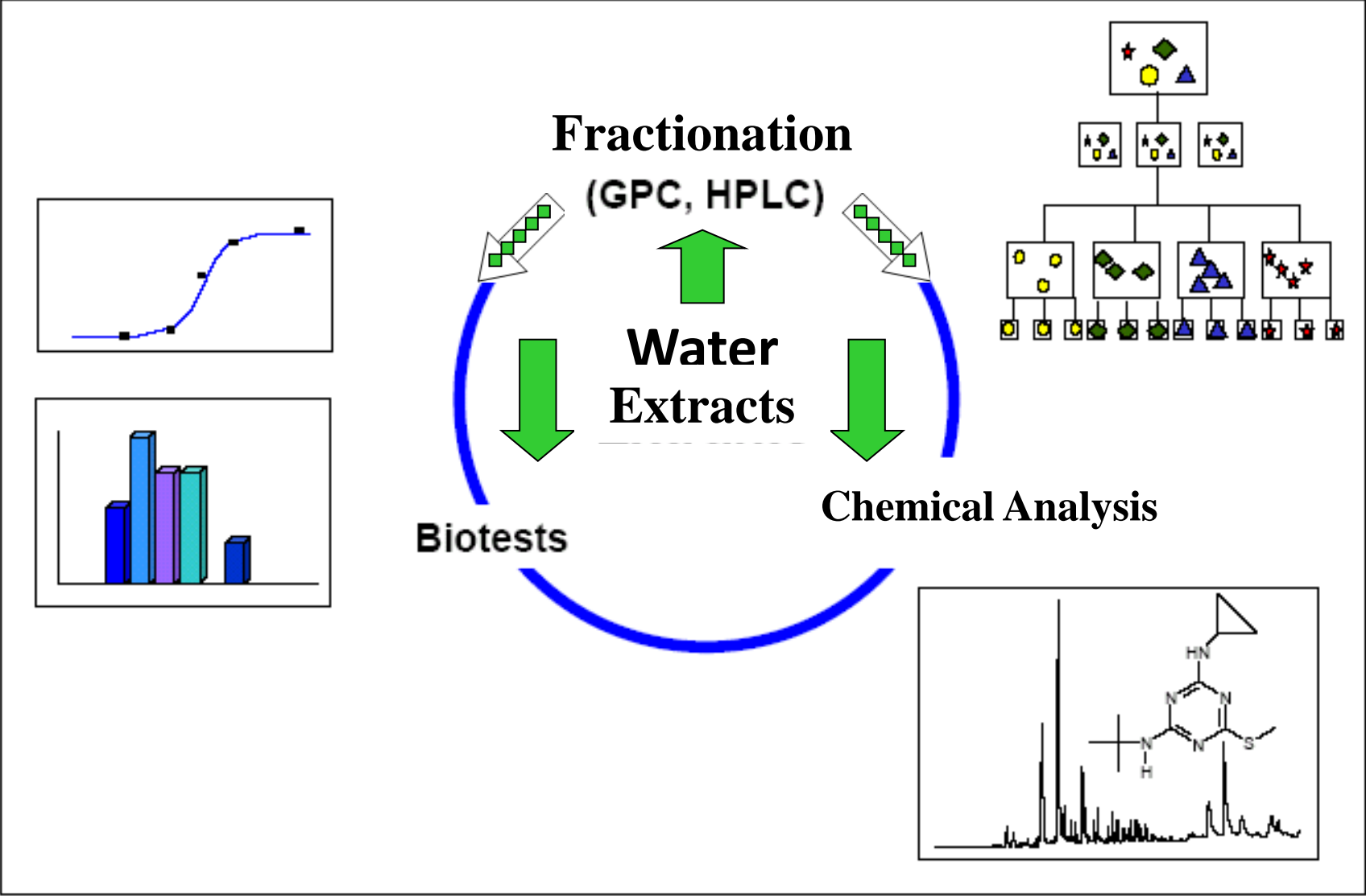


**Indus River at Kotri Barrage**



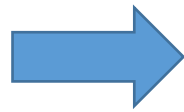


# Biotest directed Analysis



**B.) Expectation at the start of the study:**

**Dominating impact of Halogenated Pollutants such as pesticides of the first generations**



**But, now the surprise .....  
Results**

The by far dominating classes of compounds were  
**Pharmaceutical Compounds**  
and Industrial Chemicals

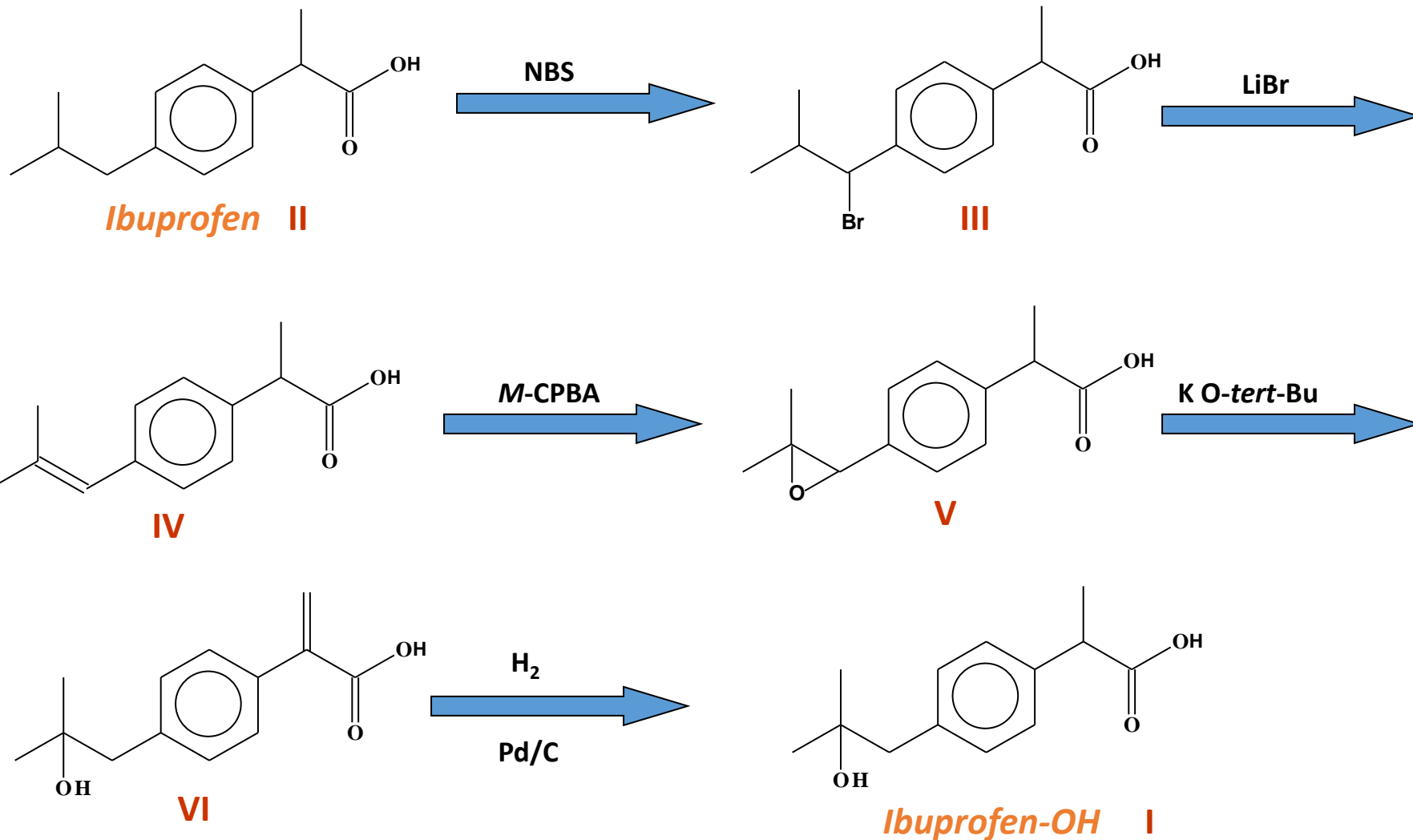
As an example this will be illustrated for  
**Dichlofenac and its Metabolites**

## Concentrations of Diclofenac and Metabolites

Compound	Sample/concentrations in [ $\mu\text{g/L}$ ]								
	1	2	3	4	5	6	7	8	9
<b>diclofenac</b>	<b>5.3</b>	<b>2.8</b>	<b>0.1</b>	<b>10</b>	<b>1.7</b>	<b>1.1</b>	<b>0.8</b>	<b>2.5</b>	<b>1.2</b>
<b>Metabolit 1</b>	?	?	?	?	?	?	?	?	?
<b>Metabolit 2</b>	?	?	?	?	?	?	?	?	?
<b>Metabolit 3</b>	?	?	?	?	?	?	?	?	?
<b>Metabolit 4</b>	?	?	?	?	?	?	?	?	?
<b>Metabolit 5</b>	?	?	?	?	?	?	?	?	?

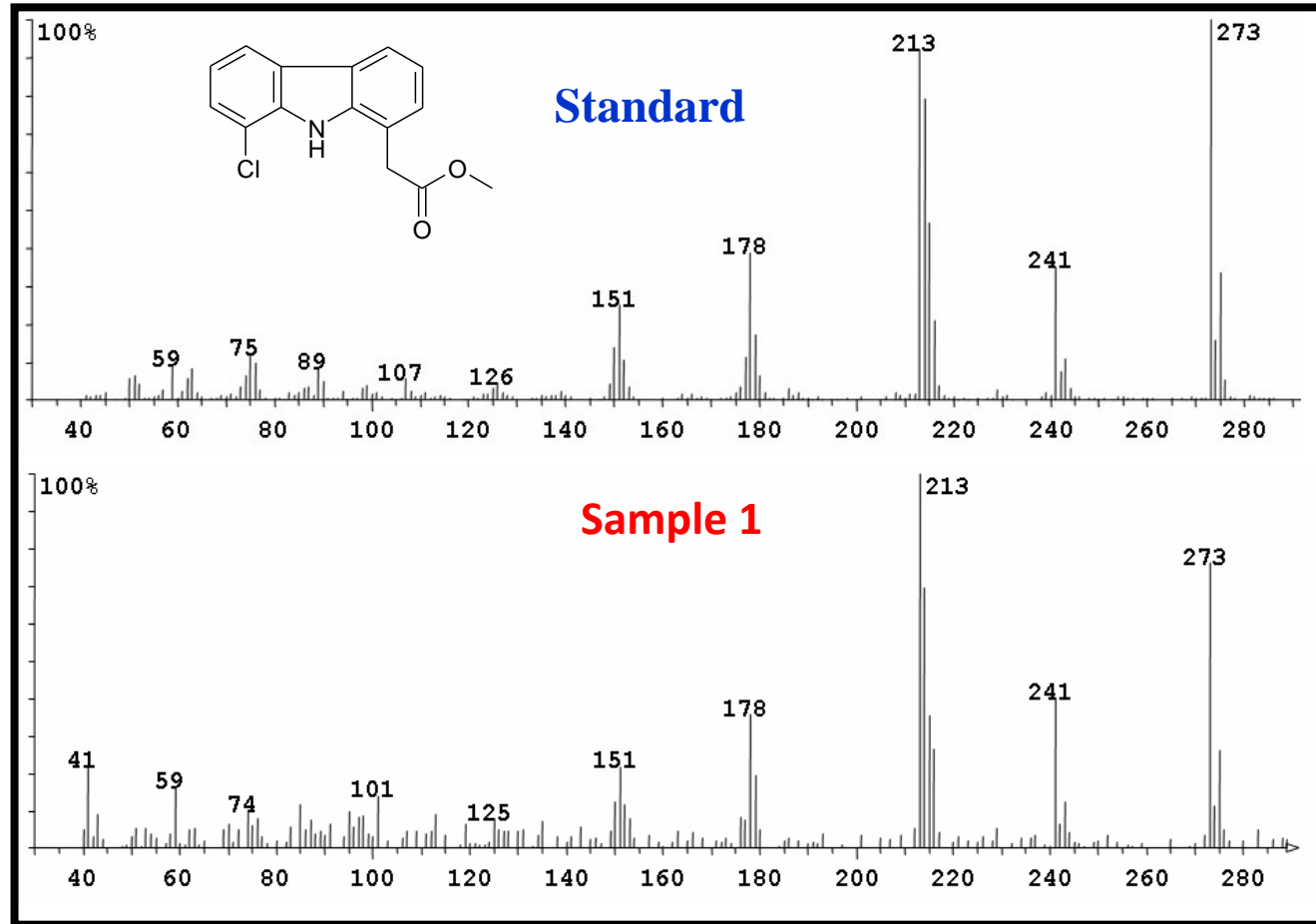
 **Fate of pollutants in the Environment**

# Synthesis of Ibuprofen-OH I



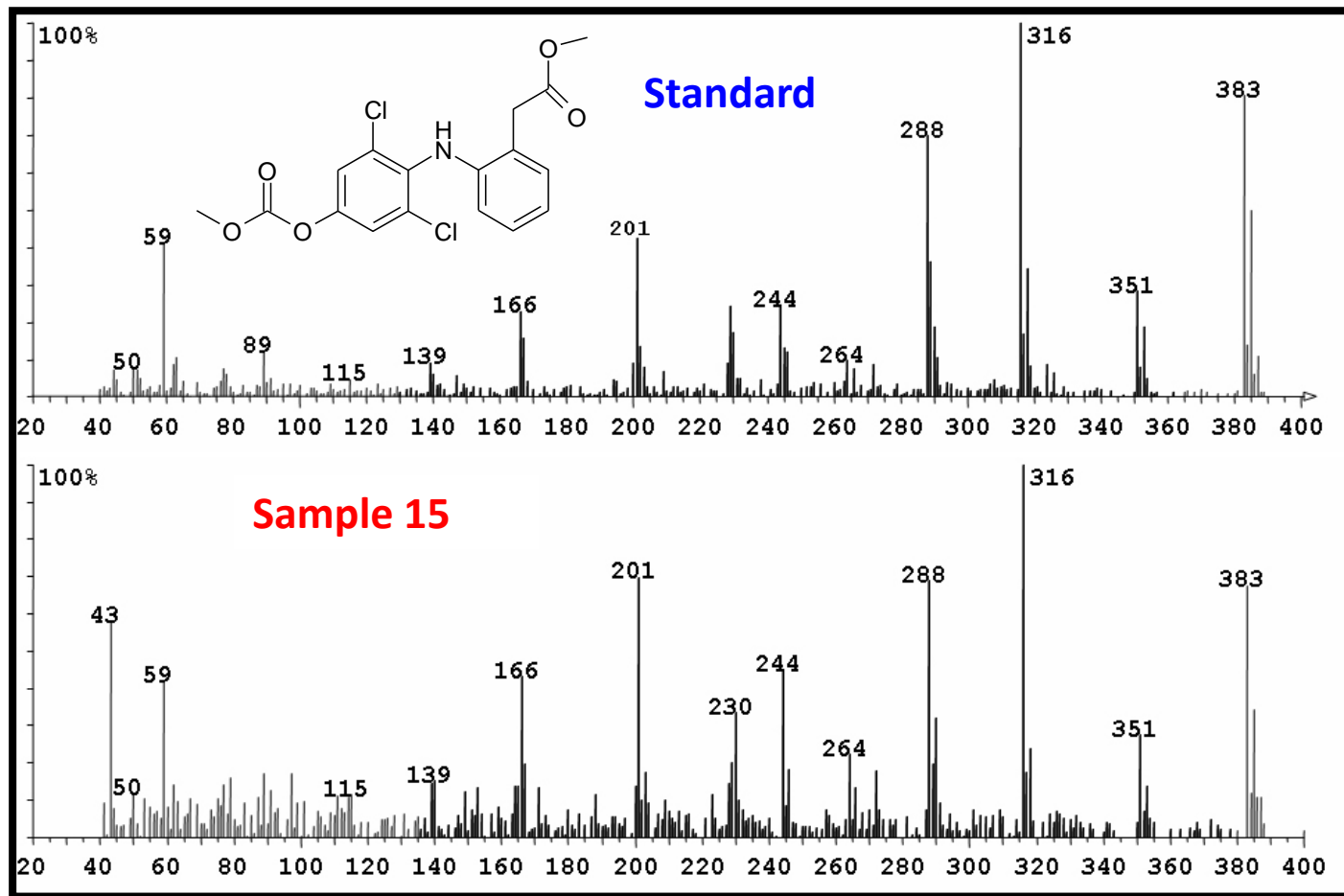


# Dichlofenac Metabolites Example 1



Mass spectra of 8-chlorocarbazole-1-yl-ethanoic acid as ester derivative;  
above: external standard; below: sample 1 extract.

# Diclofenac Metabolites Example 1

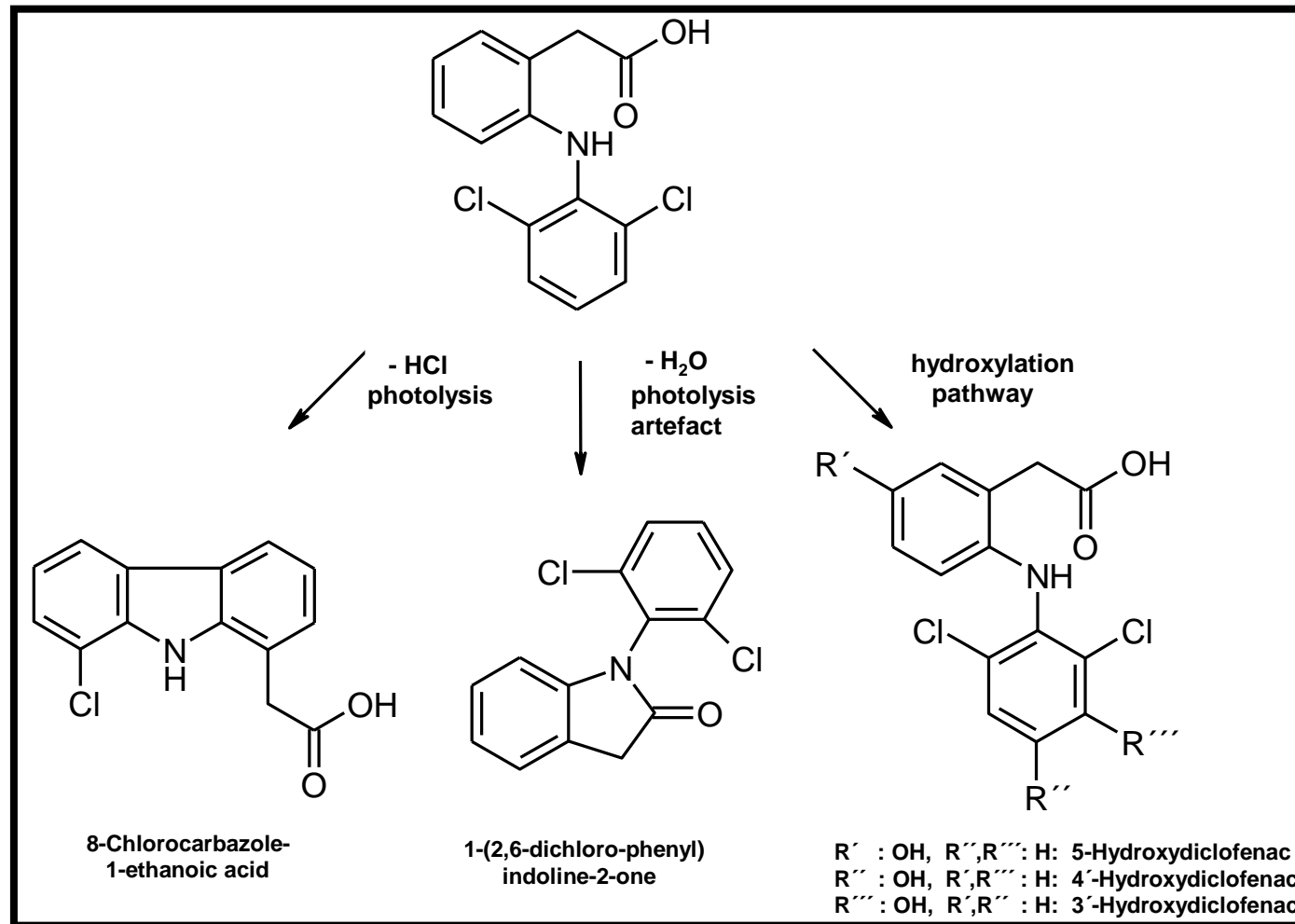


Mass spectra of 4'-hydroxyl diclofenac as MCM derivative; **above external standard**; below: **sample 15** extract.

3'-hydroxy diclofenac exhibits an identical mass spectrum



# Transformation Products of Diclofenac in the Aquatic Environment

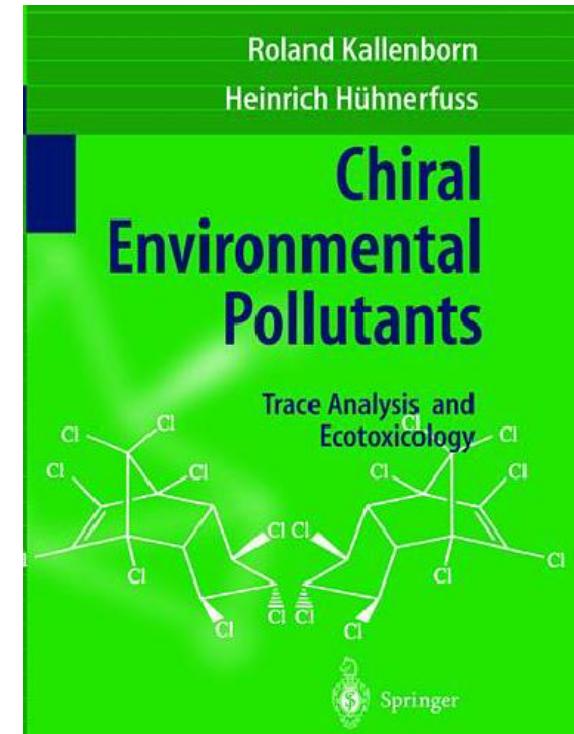


## First Take Home Message:

**Without a synthesis of not commercially available standards –  
no verification of the metabolites !**

## Second Take Home Message

**Taking into account the high Concentrations,  
Discrimination between Biotic and Abiotic  
Transformation Processes is possible  
applying **Enantioselective Chromatography**  
(not presented in this talk)**



**Third Take Home Message:**

**Taking into account the high concentrations, toxicological measurements  
allow applications of relatively easy risk assessments  
such as the Luminescent Bacteria Test or several Bioassay Tests  
(not presented in this talk)**



**Thank You !**



# Complete Sampling Area in Southern Pakistan

