

# Iodine from Seaweed

In 1811 a French scientist by the name of Bernard Courtois noticed purple fumes rising from a solution of dissolved seaweed ash from which he had mixed acid. Courtois had discovered a new element - iodine.



The concentration of iodine in seawater is incredibly small, containing at most 1 gram of iodine for every 17 cubic meters of water, but seaweed is able to extract and concentrate the iodine to levels as high as 3% by weight.

Scientists believe the kelp utilize iodine in the form of organic compounds to serve as a natural pesticide. The brown kelp varieties such as this species of *Macrocystis*, which grows along our own coast here in Carlsbad, contain the highest levels of iodine.

The idea that iodine could be extracted from kelp intrigued me so I set about to perform an experiment.



At low tide, Carlsbad beaches reveal a daily deposit of kelp at the high tide line.

The first step is to harvest a quantity of kelp



The species gathered included some green algae, and other brown species, but mostly *Macrocystis*.



The kelp is washed in fresh water and laid out to dry in the sun

Next, portions are added to a garbage can and...



Incinerated to reduce the kelp to ashes

The ash contains some unburned kelp and lots of carbon fragments and soot.



The material is further reduced in a crucible to burn off most of the remaining carbon and carbon compounds

This leaves a gray-white residue



The ash is added to a flask and mixed with distilled water

The solution is mixed well and heated over a flame to dissolve any soluble material in the ash



The solution is hot-filtered to remove the insoluble material, and the filtrate received into a flask

The filtrate is reduced in volume by boiling off the water until flocculent crystals begin to form in the bottom of the flask. This means the solution is saturated with whatever salts have been extracted. This solution is perhaps similar to what Courtois prepared in 1811.



A small portion of the solution is added to a test tube and sulfuric acid is added to decrease the pH. Hydrogen peroxide is added to liberate some of the iodine as an element. Note the pale yellow color. Is this iodine?

Starch solution is added to test



The bluish-purple color is a positive result - iodine is present!

Next I attempt to extract crystals of iodine using again acid to reduce pH, but this time a stronger oxidizer, potassium peroxydisulfate.



The chemicals are added to the remaining liquor and heated



A beaker containing ice is placed at the mouth of the flask



Any iodine that sublimates should crystallize on the bottom of the beaker



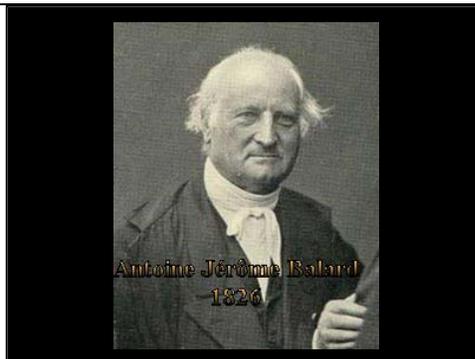
The solution begins to turn dark -  
Iodine?



No ! I recognize the strong odor.  
Note the dark brown color. Another  
halogen, one place above iodine in the  
periodic table is also present in the  
solution and has been displaced by the  
oxidizer - bromine!

The smell is so strong and irritating, I  
have to open the doors in the lab.

A little research shows another  
French scientist, Antoine Balard,  
discovered bromine in seaweed 15  
years after Courtois discovered  
iodine!



Continued heating drives the bromine  
off, and the solution turns green.  
Another Halogen appears - the  
element above bromine - I now  
recognize the familiar smell of  
chlorine.

Although iodine was shown to be  
present, my procedure somehow  
missed liberating the element -  
however led to discovering the other  
halogens.

