The Chemist's Handbook

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[illegible]

DIVISION IV.- INFREQUENTLY APPLIED POISONS

Group	0	I	II	III	IV	V	VI	VII	VIII		
Type Formula		R_2O	RO	R_2O_3	RO_2 H_4R	R_2O_5 H_3R	RO_3 H_2R	R_2O_7 HR			
Series 1		H 1 1.008									
2	He 2 4.00	Li 3 6.94	Be 4 9.1	B 5 10.85	C 6 12.005	7 N 14.008	8 O 16	9 F 19.0			
3	Ne 10 20.2	Na 11 23.00	Mg 12 24.32	Al 13 26.97	Si 14 28.1	15 P 31.04	16 S 32.06	17 Cl 35.46			
4	A 18 39.9	K 19 39.10	Ca 20 40.07	Sc 21 45.1	Ti 22 48.1	V 23 51.0	Cr 24 52.0	Mn 25 54.93	Fe 26 55.84	Co 27 58.97	Ni 28 58.68
4a		29 Cu 63.57	30 Zn 65.37	31 Ga 70.1	32 Ge 72.5	33 As 74.96	34 Se 79.2	35 Br 79.92			
5	Kr 36 82.92	Rb 37 85.45	Sr 38 87.63	Y 39 89	Zr 40 90.6	Cb 41 93.1	Mo 42 96.0	Ma 43 ?	Ru 44 101.7	Rh 45 102.9	Pd 46 106.7
5a		47 Ag 107.88	48 Cd 112.40	49 In 114.8	50 Sn 118.7	51 Sb 121.8	52 Te 127.5	53 I 126.92			
6	Xe 54 130.2	Cs 55 132.81	Ba 56 137.37	RARE EARTHS 57-71	Ct-Hf 72 178.6	Ta 73 181.5	W 74 184.0	Re 75 ?	Os 76 190.9	Ir 77 193.1	Pt 78 195.2
6a		79 Au 197.2	80 Hg 200.6	81 Tl 204.0	82 Pb 207.2	83 Bi 209.0	84 Po 210	85			
7	Rn 86 222	87	Ra 88 226	Ac 89	Th 90 232.12	Pa 91	U 92 238.2				

RARE EARTHS	La 57 139.0	Ce 58 140.25	Pr 59 140.9	Nd 60 144.3	Il 61 146 ?	Sm 62 150.4	Eu 63 152.0
Gd 64 157.3	Tb 65 159.2	Dy 66 162.5	Ho 67 163.5	Er 68 167.7	Tm 69 168.5	Yb 70 173.5	Lu 71 175.0

THE NEARLY COMPLETED PERIODIC TABLE OF THE ELEMENTS

FIGURE 1: *The possibility of arranging the elements in a beautifully interrelated system greatly facilitates research*

Arsenic, cyanide, chloroform—these compounds have nearly endless applications in agricultural and industrial settings. Unfortunately, they also can prove to be incredibly toxic if adequate precautions are not taken to reduce exposure. As such, due to their wide availability, high toxicity, and difficulty in detecting, they have become some of the most seen toxins applied to criminal uses for the performance of murder. Detecting each one presents a different scientific challenge. Take arsenic, for instance. It is tasteless and odorless. In the poisoner's repertoire, it is often mixed into food and drink. As the victim consumes the laced comestibles, they are entirely unaware that they are eating and drinking to their death until it is often too late. A death that results from ingestion of arsenic can mimic the symptoms of a natural illness, mainly if such poisoning is carried out in small portions over a long period of time. Finally, it is quickly metabolized by the body and breaks down even after death, making detection in the victims remains nearly impossible, and you can't find it in the body. Many a suspicious coroner has had their investigations fouled by the use of such a substance.

ADVANCEMENTS IN medical technology have lead to increasingly smaller and smaller tools, making the concealment of poisons incredibly easy.

Arsenic

Of the many famous poisons used today, arsenic, being among the oldest, has perhaps the most complex, convoluted, and confounding. While important in many applications, its primary use is in pest extermination. Due to this specific reason, arsenic is even today readily available on the shelves of any general store. While various brands exist, the most potent and often found in the poisoner's repertoire is "Rough on Rats."

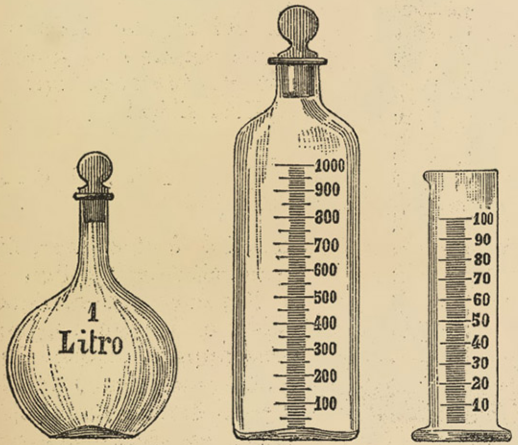
Arsenic has been used for centuries but perhaps never so famously as among the Borgias. Before the development of forensic science, it was nigh on impossible to detect. This is mainly the case when the poisoner can administer the doses gradually. Death from arsenic poisoning is often mistaken for any number of more common ailments: flu, cholera, or even heart disease. Despite this, arsenic has a tell-tale sign of involvement in an individual's death due to its toxicity to all forms of life. Anybody with sufficient levels of arsenic will also display a distinctly retarded rate of natural decomposition.

Due to these factors, many have applied a macabre moniker to arsenic: "inheritance powder"!

Detection of Arsenic

When dried and heated over an open flame, preferably in a glass vial, arsenic compounds will readily ignite, leaving a black residue and the distinct smell of garlic. Caution must be exercised not to inhale the toxic gasses along with the odor.

To make on-site identification of arsenic possible, all an investigator needs to have is a test tube, an open flame (or similar heat source), and a means to safely hold the tube as it is heated.



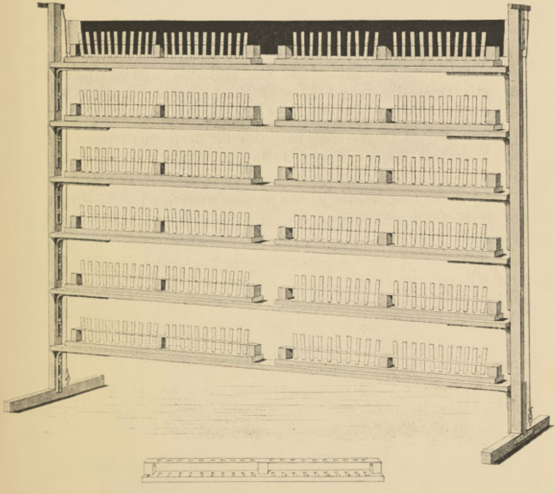
Atropine (Belladonna)

Atropine is derived from Atropa belladonna, the deadly nightshade. Despite its disturbing name, it has a myriad of medical applications. Because it grows as a weed in many places, it is almost always available within arm's reach. Due to its natural prevalence, belladonna is often the first choice of many amateur poisoners. Both foliage and berries of the plant are toxic, containing a mixture of alkaloids including scopolamine and atropine. Although, concentrations of the substances are usually much higher in the berries. Like arsenic, belladonna has quite the presence in world history: both Emperor Augustus and Agrippina (wife and sister of Claudius) used belladonna to significantly remove those standing in their way to power.

Symptoms of atropine poisoning include dilated pupils, blurred vision, racing heart rate, dry mouth, slurred speech, confusion, and hallucinations.

Detection of Atropine (Belladonna)

There is currently no available field test for the presence of atropine. All that can be recommended at this time is to record eyewitness accounts of the victim's displayed symptoms before death and compare them to the description of symptoms provided here.



Cyanide

Found, to varying degrees, in the seeds of many members of the Rosaceae (which includes cherries, apricots, and almonds). Cyanide is a quick-acting poison. Its exact method of toxigenicity is unknown, but current theories suggest it inhibits cellular respiration in the body, effectively suffocating the victim's cells. Despite this, exposure to the compound can result in the victim's skin remaining pink, even after death (but not the cherry-red of carbon-monoxide poisoning), despite the occurrence of cellular hypoxia. In high concentrations, death can occur within minutes. Much like arsenic, chronic ingestion causes various symptoms ranging from generalized weakness, confusion, and bizarre behavior. If exposure continues over long enough periods, paralysis and liver failure can result before death.

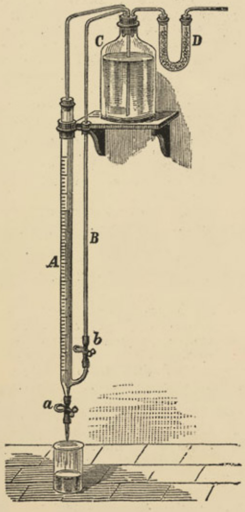
Various forms have been explored as treatments for cancer, under the name "Amygdalin" or its semisynthetic derivative "Laetrile." Due to the mistaken belief that all cancers result from a vitamin B-17 deficiency, laetrile was marketed as vitamin B-17 before it was determined it was much too toxic to be of any beneficial medical use. However, the moniker of B-17 persists, in some cases, to this day in various forms of the poison.

In another startling similarity to arsenic, cyanide is widely available due to its many applications in pest control.

Detection of Cyanide

Even in amounts too small to be easily detected, cyanide readily reacts to benzidine or Iron (II) sulfate when mixed together. In an aqueous solution of cyanide to which either benzidine or Iron (II) sulfate are introduced, the result should be an opaque solution with a brilliant blue in hue.

Any homicide investigator would avail themselves by including either of these compounds in their chemical detection kit.



Chloroform

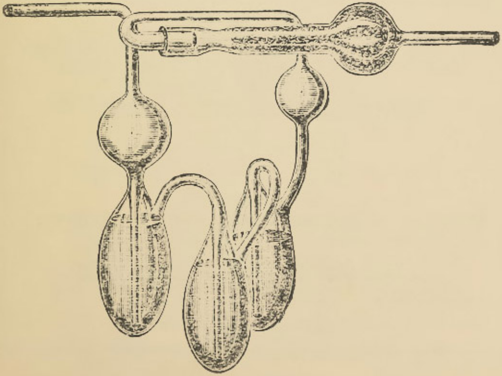
Professor James Simpson's application of chloroform as an aid to medical surgery is perhaps the most significant advancement in medical technology to date. It is, to put it quite simply, the perfect anesthetic. Despite this, or perhaps because of it, chloroform can be efficiently utilized, to deadly effect, if one's intentions are bent towards murder rather than medical aid.

Like many such "poisons" listed herein, chloroform is as much a boon to man as it is a curse. For instance, it can readily be applied to the treatment of asthma. Despite its prevalence, however, if inhaling chloroform is not an option, smoking saltpeter, inhaling the smoke of burning coffee, or cigarettes containing thornapple can be adequate substitutes until supplies of chloroform can be replenished.

Those who would use chloroform as a poison often do so by soaking a handkerchief or rag with the substance and forcing the victim to inhale the fumes. Contrary to the pages of crime fiction novels, such incapacitation requires significant time. Additionally, consciousness is usually regained upon removing the item soaked in chloroform. Any death due to chloroform would require considerable time and effort, as only prolonged exposure renders the victim sufficiently unconscious for them to expire spontaneously. The expert poisoner would only employ chloroform as a means to enable the administration of some more powerful and quicker acting drug.

Detection of Chloroform

Since chloroform readily evaporates to gas and dissipates rapidly in the open air, detection can be nearly impossible for even the most astute of investigators. In such instances, it is essential to remember that the same quality that makes chloroform so hard to detect can also be a detriment to any poisoner's attempts at anonymity. To be successfully applied as a poison, chloroform must be inhaled for an extended period of time. To prevent premature evaporation of the chloroform, any poisoner would therefore be forced to carry around sufficient amounts of chloroform to render their victims unconscious. This requires the poisoner to keep a large bottle, usually glass or metal, either on their person or nearby. Disposing of such an obvious item can also prove challenging.



Strychnine

While deadly in its own right, strychnine occupies a unique place in the world of poisons in that it is much more often seen mentioned in the pages of pulp and serial novels than in actual murders. Factors that make it appealing for the sensationalist writer, but less so for any would-be murder suspects, are that it is so easily absorbed after ingestion that its effects are rapid and impressively dramatic.

As with many deadly poisons, their origins lie in botany. Strychnine is an alkaloid extracted from the seeds of the tree Strychnos nux-vomica. Once obtained, it is further refined and concentrated to great potency. While strychnine's method of toxicity in the body is not yet fully understood, its effects are no less deadly. The current belief is that it inhibits motor response in the nerves leading to and from the spine. This conclusion comes from observing its immediate effects prior to the expiration of an exposed subject. Initial evidence of strychnine poisoning manifests as uncontrollable muscle twitches that increase to full-on muscle contractions resulting in the classic trismus and risus sardonicus. These contractions continue to intensify and spread, throughout the body, from the point of ingestion. Despite what pulp writers would have you believe, no antidote exists. However, proper medical attention can alleviate the symptoms until recovery or eventual death, usually two to three hours post initial exposure. Death is most often due to respiratory failure. However, the near-constant convulsions complicate this cause of death by adding lactic acidosis and failure of the kidneys to the list of immediate ailments.

Detection of Strychnine

Insoluble in water and only soluble with great difficulty in alcohol, strychnine can almost always be relied upon to leave a visible residue when means of delivery is intended by ingestion of a liquid.

A chromic acid test is an effortlessly easy test for strychnine. If the remaining residue can be successfully obtained from the victim's food or drink, adding it to a weak potassium chromate solution dissolved in dilute sulfuric acid should elicit a spectrum of colors. The solution should initially appear blue before proceeding to purple, then red, before finally settling to an orange hue.

This test is so reliable any medical examiner would be sorely remiss if they did not include chromic acid among the other essential items in their crime scene test kit.

Thallium

Thallium is a heavy, diamagnetic metal with properties very similar to those of lead. All of the salts of thallium are poisonous, and as little as 1 gram of thallium carbonate is enough to kill a rabbit in a few hours. Though often administered as an injection, thallium can be absorbed topically, ingested, or inhaled. Additionally, it is colorless and tasteless, dissolves in water, and has a slow onset of vague symptoms. The only actual deficit thallium has as a poison is its relative unavailability.

Symptoms of thallium poisoning can first appear relatively unremarkable. Vomiting usually appears first, followed by diarrhea. After which, a range of neurological symptoms begin to present themselves. If administered in small doses, over time, death is usually by fatal cardiac attack some three weeks after adequate exposure. Hair loss is a standard indicator of thallium exposure. When given in sufficient quantities to trigger immediate onset of death, loss of muscular function, trembling of limbs, and death by asphyxia usually result.

Detection of Thallium

Isolation of thallium from bodily fluids or tissue requires several steps that cannot be undertaken on-site. The proper chemical procedures can be conducted to isolate the compounds necessary for testing in a laboratory or medical setting. The isolated material can be burned directly in a flame and viewed through a prism or optical spectroscope if thallium is suspected. If thallium is indeed present, a magnificent green line will become visible corresponding with wavelength 534.9; in rare instances, a second green line may also be present at wavelength 568. While suspected substances could be directly tested in this way in the field, it is not recommended, as light conditions are rarely optimal for adequate identification.