



AKRON RUBBER DEVELOPMENT LABORATORY, INC.

EST. 1962



CHEMICAL / ANALYTICAL TESTING & REVERSE ENGINEERING SERVICES

Understand What's Really In Your Compound.

Formula Reconstruction • Reverse Engineering • Chemical Analysis

ARDL analyzes rubber and plastic materials—from component identification and formula reconstruction (reverse engineering) to failure investigations—helping you troubleshoot problems, verify materials, and optimize performance.

WHEN DO YOU NEED CHEMICAL ANALYSIS?

- Investigate product failures
- Verify raw material quality
- Benchmark competitor compounds
- Identify contamination or unknown substances
- Support litigation or patent disputes
- Ensure regulatory and specification compliance
- Reduce formulation and development costs

WHY CHOOSE ARDL?

- ISO-accredited laboratory supporting global compliance requirements
- Independent third-party testing you can trust
- Decades of polymer expertise in rubber and plastics
- Formula reconstruction and reverse engineering expertise
- Support for R&D, QA, regulatory compliance, and certification
- Custom test development and analytical problem solving

WHAT ARDL CAN IDENTIFY

ARDL provides formula reconstruction, reverse engineering, and analytical testing to identify the chemical causes behind failures — **turning analytical data into actionable insight.**

Failure, Degradation & Contamination

- Environmental stress cracking
- UV degradation & blooming
- Unknown materials & contaminants
- Manufacturing defects

Analytical Techniques & Testing

- FTIR/ATR spectroscopy
- Mass chromatography (GC, LC, ICP)
- Elemental analysis
- Thermal analysis

Reverse Engineering & Competitive Benchmarking

- Competitor product analysis
- Formula reconstruction
- Performance comparison

Medical & Regulatory Compliance

- Extractables & leachables
- Permeation & barrier testing
- Chemotherapy & toxic chemical resistance
- FDA & medical device support

Material Identification & Composition

- Polymer & blend identification
- Formula reconstruction
- Additives & fillers



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Example: Typical Rubber Compound Analysis & Carbon Black Typing

COMPOUND ANALYSIS

Date: January 10, 2022
Attention: Ms. Mary Ann Jones
Address: XYZ Corporation

Sample ID: Competitor's Rubber
Sample Color: Black
Project No.: 123456

A	Polymer Identification (Infrared Spectroscopy)	Percent of RHC
1	Polyisoprene Rubber.....	80
2	Styrene-Butadiene Rubber.....	20
B	Ash Content.....	9.8%
C	Semi-Quantitative Ash Analysis (ICP Mass Spectroscopy and EDX)	
a	>10%.....	Si
b	5-25%.....	Zn
c	1-10%.....	
d	0.5-5%.....	
e	0.1-1%.....	CA
f	0.05-0.5%.....	
g	0.01-0.1%.....	Mg, Al
h	Below Detection.....	Bi, P, Ti, Mn, Sn, Na, Fe, Ni, Cu, Se, Sb, Ba, Pb
D	Total Hydrocarbon.....	55.5%
E	Total Sulfur, Leco Method.....	1.60%
F	Density.....	1.193 Mg/m ³
G	Wax Content.....	Present

H	Extractables Solvent Extractables, %.....	8.1%
1	Color.....	Amber
2	Consistency.....	Semi-Solid
I	Carbon Black.....	25.0%
1	ASTM Series Black.....	N300
J	Extract Analysis	
1	Plasticizers	
a	Hydrocarbon Oil	
b		
c		
2	Antioxidants	
a	Santoflex 6PPD	
b		
c		
3	Accelerators (Suggested)	
a	Sulfenamide (TBBS)	
b	Santogard PVI	
c		
K	Beilstein, Presence of Halogens	Negative
L	Microhardness IRHD.....	61

General information provided by a reverse engineering analysis:

- Accelerators - Qualitative Only
- Antioxidant Identification
- Carbon Black Content
- Halogen Presence
- Percent Total Extract
- Plasticizer Identification
- Rubber Hydrocarbon Content
- Polymer/Polymer Blend Identification
- Filler Types and Percents
- Specific Gravity
- Theoretical Formula Reconstruction
- Total Sulfur Content
- Wax Content
- Hardness



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Example: Reverse Engineered Formula Reconstruction

INGREDIENT	PHR	EXTRACT.	ASH	VOLUME
Polyisoprene Rubber	80.0	0.8		86.0
Styrene-Butadiene Rubber	20.0	0.2		21.3
Carbon Black (N300 Series)	44.8			24.9
Silicon Dioxide	15.2		14.6	7.6
Zinc Oxide	3.0		3.0	0.5
Hydrocarbon Oil	7.2	7.2		8.0
Stearic Acid	1.0	1.0		1.1
Santoflex 6PPD	2.5	2.5		2.5
Hydrocarbon Wax (C19-C37)	2.0	2.0		2.3
Misc. Extractables*	0.5	0.5		0.6
Sulfenamide (TBBS)	1.0	0.3		0.7
Santogard PVI	0.3	0.1		0.2
Sulfur	1.9			0.9
TOTALS	179.4	14.6	17.6	156.6

Calculated Ash Content.....	9.8%
Calculated Extractables.....	8.1%
Calculated Carbon Black.....	25.0%
Calculated Density (Mg/m³).....	1.145

*Comments: It may contain rosin acids, accelerator fragments and other reaction products, etc.

Note: Reconstructed formulation is based on analytical data from your sample. The above calculated percentages are based on the reconstructed formulation.

To further enhance and more exactly match an unknown material, the following tests can also be performed:

- Acrylonitrile Content
- Free Sulfur Content
- Resin Identification
- Regulatory Screening
- Antioxidant/Antiozonant Quantification
- Fiber Identification
- Thermal Analysis (DSC, DMA, TMA and TGA)
- Quality Control
- Carbon Black Typing
- Halogen Content Analysis
- Formula Compliance
- Failure Analysis
- Pyrolysis GC/MS
- Off-Gassing