

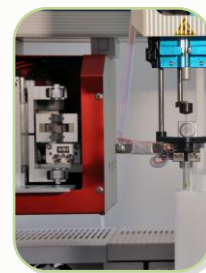
## Difficult Matrix Introduction

GC analysis of dirty sample extracts and raw samples is now possible with Difficult Matrix Introduction (DMI). No expensive and time consuming cleanup is required with this technique.

### Why DMI?

DMI is based on the patented Direct Sample Introduction (DSI) technique\*. It enables sample introduction into the GC column to be performed from a disposable sample container (micro-vial) placed inside an inlet liner. This has great advantages over traditional injections - larger volume (up to 30  $\mu$ l) of dirty sample extract or raw sample can be introduced directly into GC or GC/MS.

Selective exclusion can be used to only transfer those peaks of interest from the inlet onto the column through the positive use of discrimination. The remaining sample may be vented through the split line or kept in the DMI micro-vial, which may be replaced when necessary.



## How it works

In general, DMI is very simple. It requires OPTIC GC inlet that can accommodate a large capacity glass liner with 3.4 mm internal diameter (Fig. 1a). A fraction of a liquid or solid sample is transferred into a micro-vial (Fig. 1b), which is placed on the neck of a DMI liner (Fig. 1c). Further, the liner is transported into the inlet for analysis (Fig. 1d). The injection conditions are carefully controlled to optimize the transfer of analytes while minimizing the transfer of matrix components.

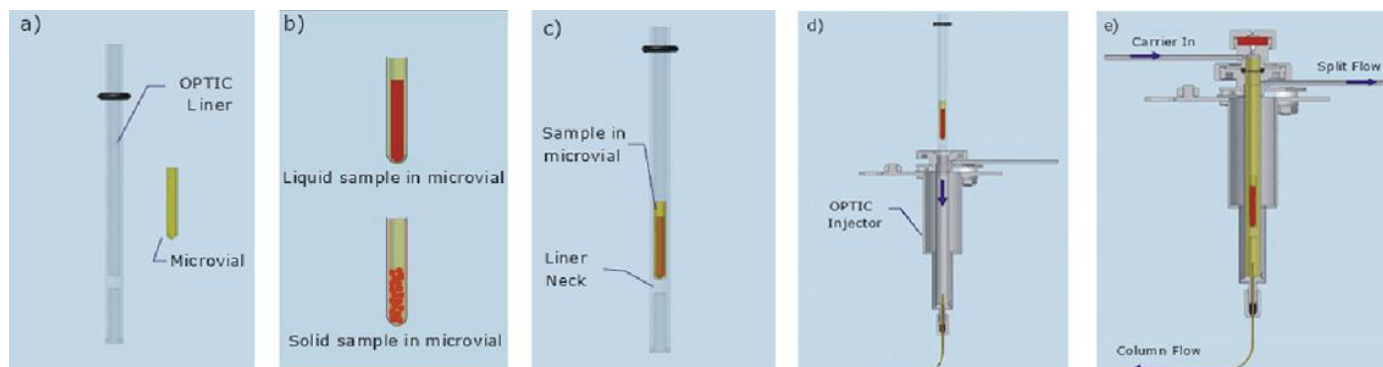


Fig. 1

An automated version of DMI is available with ATAS GL LINEX-DMI. It offers the possibility to automatically exchange the liners between the inlet and the liner tray. The liner is transported by the PAL COMBI-xt sampling robot equipped with a pneumatic gripping arm. Every time, on the completion of the chromatographic run, the inlet liner containing the DMI micro-vial is changed automatically to avoid possible build-up of non-volatile matrix components in the GC system. The micro-vial is then disposed to waste but the liner can be cleaned and re-used.

LINEX can be equipped with a Capping-De-Capping (CDC) device. It works with the OPTIC liners which are capped from both sides in order to protect sample from deteriorating influences of the environment or keep them clean after conditioning. With the CDC unit, the liner is decapped just before it is placed into the GC inlet.

The applications of DMI is not limited at all to the types of samples listed above. In fact, any complex total extracts like biological fluids, tissue extracts, food, plant or soil can be analyzed with minor standardized sample preparation. Raw samples like powders, bio-aerosols, crude oils, glues, shampoos, cosmetic products etc. can be directly put into a micro-vial and analyzed using GC or GC/MS system.

## Key DMI Advantages

- Direct in-inlet analysis of sample extracts with nonvolatile matrix;
- No expensive cleanup steps needed;
- In-liner derivatization possible;
- Automated liner exchange possible (requires ATAS GL LINEX);

## DMI Choice

DMI can be performed in various ways depending on the sample type and the analytical method requirements. Table below lists most frequently used options. In some cases the use of a needle guide is required to ensure accurate sample injection directly into micro-vial.

Sample Type	Sample Introduction	Needle Guide Type	CDC Unit Use	Syringe Needle	Sampling Sequence
Non-viscous	Injection into inlet, LINEX head closed	L100012 Glass Needle Guide	Not possible	80 mm	A
Non-viscous	Injection into inlet, LINEX head open	L100013 Metal Needle Guide/ L100012 Glass Needle Guide	Possible with L100013 only	70 mm	B
Non-viscous	Injection on tray	L100013 Metal Needle Guide/ L100012 Glass Needle Guide	Possible with L100013 only	70mm	B
Viscous	Manual, outside inlet	Not needed	Possible	-	C
Solid	Manual, outside inlet	Not needed	Possible	-	C

## Sampling Sequences

### A. Liquid sample extract injected directly into inlet with closed LINEX head

1. Load liner tray with liners, micro vials and glass needle guides;
2. Initiate analysis sequence via PAL software;
3. PAL takes first liner and places it into the inlet;
4. PAL takes an aliquot of liquid sample from a sample vial using syringe;
5. PAL injects sample into the micro-vial;
6. Sample is desorbed into GC column and analysis is started;
7. On analysis completion, liner is removed from the inlet and replaced with the clean one;
8. Next sample is selected and sequence 3-7 is repeated;

#### Required hardware:

- GC or GC/MS;
- PAL COMBI-xt;
- LINEX DMI Tapered Liner (L100011);
- DMI glass needle guide (L100012);
- OPTIC-3 or OPTIC-4 inlet;
- LINEX-DMI Liner Exchanger (2411-3002);
- DMI micro-vial (2406-1010);
- 10µl Syringe 22s cone tip 80mm needle (2106415)\*;

\*CTC 10µl syringe adapter and plunger holder is required

### B. Liquid sample extract injected into liner situated on tray or into inlet with opened LINEX head

1. Load liner tray with liners and micro vials;
2. Initiate analysis sequence via PAL software;
3. PAL takes metal needle guide and places it into liner;
4. PAL takes an aliquot of liquid sample from a sample vial using syringe;
5. PAL injects sample into the liner with the needle guide;
6. PAL removes the needle guide from the liner;
7. PAL takes the liner with the sample and transfers it into inlet;
8. Sample is desorbed into GC column and analysis is started;
9. On analysis completion, liner is removed from the inlet and replaced with the clean one;
10. Next sample is selected and sequence 3-9 is repeated;

#### Required hardware:

- GC or GC/MS;
- PAL COMBI-xt;
- LINEX DMI Tapered Liner (L100011);
- DMI metal needle guide (L100013);
- OPTIC-3 or OPTIC-4 inlet;
- LINEX-DMI Liner Exchanger (2411-3002);
- DMI micro-vial (2406-1010);
- 10µl Syringe 22s cone tip 80mm needle (2106415) or 10µl Syringe 22s cone tip 70mm needle\*;

\*CTC 10µl syringe adapter and plunger holder is required.

### C. Solid sample with difficult matrix

1. Place sample into micro-vial manually (usually 1mg or less);
2. Load tray with liners and micro vials;
3. Initiate analysis sequence via PAL software;
4. PAL takes the liner with the sample and transfers it into inlet;
5. Sample is desorbed into GC column and analyzed;
6. On analysis completion, liner is removed from the inlet and replaced with the another one;
7. Next sample is selected and sequence 4-6 is repeated;

#### Required hardware:

- GC or GC/MS;
- CombiPAL or PAL COMBI-xt;
- LINEX DMI Tapered Liner (L100011);
- Capping-De-Capping Station (optional)
- OPTIC-3 or OPTIC-4 inlet;
- LINEX-DMI Liner Exchanger (2411-3002);
- DMI micro-vial (2406-1010);

### D. Solid sample with difficult matrix and with internal standard liquid injection

Here a combination of A with B or C can be made.

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